Navy Experimental Diving Unit
321 Bullfinch Road
Panama City, FL 32407-7015

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OXYGEN-ACCELERATED DECOMPRESSION OF SUBMARINE RESCUE AND DIVING RECOMPRESSION SYSTEM (SRDRS) OPERATORS AND TENDERS

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Author: WAYNE A. GERTH, Ph.D.
Principal Investigator

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Efficient operation of the Submarine Rescue and Diving Recompression System (SRDRS) will require repetitive hyperbaric exposures of Pressurized Rescue Module Operators and Surface Decompression Chamber Tenders. To support this requirement, decompression tables for oxygen-accelerated decompressions from repetitive sub-saturation air dives were developed in present work based on a deterministic algorithm parameterized with a probabilistic model of DCS occurrence. Eight two-dive profiles with individual dives to depths of 30 to 60 fsw and bottom times up to 6 hr were constructed with the algorithm and tested in 125 man-dives, yielding an overall DCS incidence of 2.4% (3 DCS/125 man-dives). The three DCS cases observed in these tests occurred on profiles with dive pairs to 60 fsw. One case was a relatively severe Type II DCS incident. Oxygen breathing requirements in the man-tests were supported with the MBS 2000 Hyperbaric Oxygen Treatment Pack (HOTP), a lightweight closed-circuit breathing apparatus planned for use in actual DISSUB rescue scenarios. The MBS 2000 was found able to support the oxygen breathing requirements of the decompressions, but only with constant monitoring of diver inspired oxygen fraction and with oxygen utilization rates that averaged 3.2 L/min·man. The algorithm developed in this work, and decompression tables computed with the algorithm, provide means to prescribe relatively low DCS risk alternatives to other available procedures for managing repetitive hyperbaric exposures of PRM Operators and SDC Tenders in SRDRS operations.

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INTRODUCTION

BACKGROUND

The Deep Submergence Rescue Vehicle (DSRV) is currently the principal asset for submarine rescue in the U.S. Navy. This vehicle is designed to transport personnel rescued from a disabled submarine (DISSUB) to the safety of an awaiting Mother Submarine (MOSUB). The DSRV-MOSUB system will be phased out of the Navy inventory during this decade and replaced with the Submarine Rescue and Diving Recompression System (SRDRS). The SRDRS is currently under contract and scheduled to be operational by FY 06. The SRDRS has two components (Figure 1): (1) a Pressurized Rescue Module (PRM) capable of transporting up to 16 rescued personnel under pressures up to 5 ATA from the DISSUB to a surface ship, and; (2) a Deck Recompression System (DRS) consisting of a Hyperbaric Transfer Chamber (HTC), a Deck Transfer Lock (DTL), and two 36-man capacity Surface Decompression Chambers (SDCs) into which rescued personnel can be transferred under pressure and safely decompressed to atmospheric pressure aboard the rescuing surface ship.

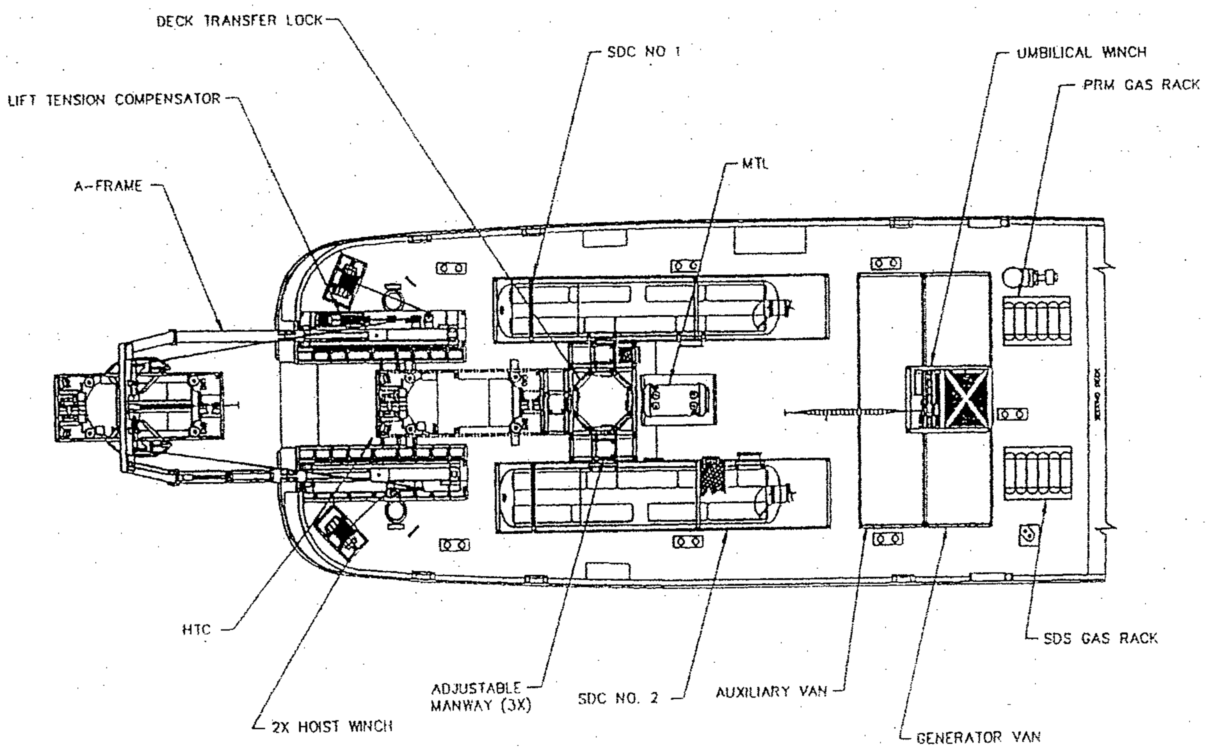

Figure 1. Schematic of the Submarine Rescue and Diving Recompression System (SRDRS) installed on the after-deck of a TATF, or ocean going tug, Vessel of Opportunity (VOO).

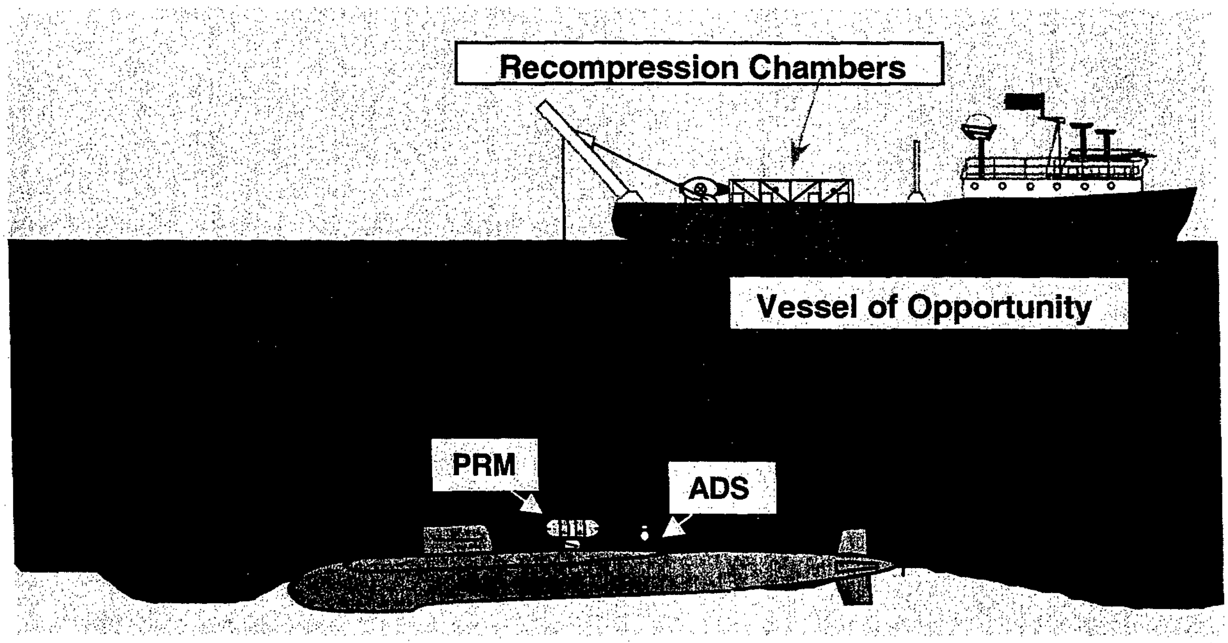

Figure 2. Artist's rendition of SRDRS usage in DISSUB rescue, augmented by diver in the Atmosphere Diving Suit (ADS).

The SRDRS concept of operations, schematized in Figure 2, has been developed to support rescue of up to 155 personnel from a pressurized DISSUB. The PRM accommodates 16 rescuees per trip and requires two Operators. Each SDC can accommodate up to 36 persons (32 rescued personnel and four Tenders). Two PRM trips, or sorties, to and from the DISSUB will therefore be required to fill each SDC before decompression of its occupants can commence. At least 10 sorties will be required to rescue a 155-man DISSUB crew. It is anticipated that each PRM Operator/SDC Tender will be a Second Class Diver qualified as an inside chamber tender/Diving Medical Technician (DMT).

Earlier phases of this program completed at NEDU resulted in the issue of interim guidance for oxygen-accelerated decompression of DISSUB rescuees.[1] This guidance included provision to allow PRM operators/SDC tenders to participate in a repetitive sortie only after completion of a 24 hr surface interval following emergence from the SDC. As a result, a minimum of 20 PRM operators/SDC tenders will be required to complete the minimum 10 PRM sorties necessary to rescue a 155-man DISSUB crew. On the other hand, opportunities for potential repetitive sorties by Operators/Tenders can be contemplated that would reduce minimum PRM/SDC Operator/Tender manpower requirements.

OBJECTIVES

The objective of the present study was to develop and man-test oxygen-accelerated decompression schedules for repetitive sub-saturation air exposures by SRDRS PRM Operators and SDC Tenders in pressurized DISSUB rescue scenarios. A secondary objective was to evaluate the performance of the MBS 2000 Hyperbaric Oxygen Treatment Pack (HOTP) (Dive Systems International),[2] a lightweight closed-circuit breathing apparatus planned to support oxygen breathing requirements of decompression schedules in actual DISSUB rescue scenarios. This study was undertaken under Naval Sea Systems Command Task Assignment 01-10[3] as the final phase of development of oxygen-accelerated decompression procedures for personnel involved in DISSUB rescue scenarios.

METHODS

TABLE GENERATION

Repetitive exposures of a limited number of Operators and Tenders can reduce man-power requirements of SRDRS operations only if each exposure incurs a relatively low risk of DCS. The table generation process was consequently based on a probabilistic model of DCS occurrence that allowed explicit specification of an acceptable DCS risk for computed schedules. The NMRI98 probabilistic model,[4,5] which accommodates the potential influence of breathing high oxygen partial pressures, was selected for this purpose.

While probabilistic models can be used to directly compute schedules for repetitive dives, they are not readily used to produce repetitive dive tables in the convenient format of the air diving tables in the U.S. Navy Diving Manual.[6] In order to produce such tables in present work, a method described by Gerth and Johnson[7] was used to map the NMRI98 model into the deterministic Thalmann Algorithm (also known as the EL-RTA or Exponential-Linear Real Time Algorithm).[8] The method parameterizes the deterministic algorithm to compute schedules at any pre-specified risk of DCS. The resultant algorithm is then readily used to produce tables for repetitive diving in the desired U.S. Navy Diving Manual format.

A standard set of 6,250 dive profiles was first built by assembling profile templates in which the properties of each profile were specified by random selection from the pools of possible properties given in Table 1. The NMRI98 probabilistic model was then used to compute the decompressions required to complete these templates at 1.5% fixed conditional DCS risk, assuming that the subject breathes 95% O_2 during the decompression, interrupted by 15 min of air breathing after each 60 min of 95% O_2 breathing. Decompression stops were fixed at 10 feet seawater (fsw) increments from surface, and 10 fsw was the shallowest allowed decompression stop. The decompression rate to the first stop and between stops was fixed at 30 fsw/min.

Table 1.
Allowed Properties of Profiles in the Standard Set Used in Present Work.

Dives/Profile:	1, 2, or 3
Dive depths:	40 to 70 fsw, 10 fsw increments
Dive bottom times:	5 to 480 min, 5 min increments
Descent rates:	all 60 fsw/min
Ascent rates:	30-120 fsw/min, 5 fsw/min increments
Surface interval times:	30-720 min, 5 min increments

Ascent decisions in the Thalmann Algorithm are based on the prevailing values of gas tensions in a series of *n* hypothetical tissue compartments. A diver is allowed to ascend to any depth at which the prevailing gas tensions in all compartments are less than or equal to corresponding compartmental Maximum Permissible Tissue Tensions (MPTTs). The MPTT, also called an MVAL (*M*), for the i^{th} compartment is generally a function of depth, D, and a vector, β_i, of Ω fundamental parameters:

$$M_{i,D} = f(\beta_i, D);\ \beta_i = [\beta_{i,1}, \ldots, \beta_{i,\Omega}]. \tag{1}$$

In present work, a 9-compartment ($i = 1, \ldots, 9$) Thalmann Algorithm was used with the MPTT at each depth given by:

$$M_{i,D} = M_{i,0} + a_i D + b_i D^2. \tag{2}$$

Thus, the β_i in Eq. (1) are rows of a 9×3 matrix, β:

$$\boldsymbol{\beta} = \begin{bmatrix} \boldsymbol{\beta}_1 \\ \vdots \\ \boldsymbol{\beta}_9 \end{bmatrix} = \begin{bmatrix} M_{1,0} & a_1 & b_1 \\ \vdots & & \\ M_{9,0} & a_9 & b_9 \end{bmatrix}. \tag{3}$$

With other EL-RTA constants fixed at values associated with the VVal18 MPTT table (PACO2=1.5 fsw; PH2O=0.0 fsw; PVCO2=2.3 fsw; PVO2=2.0 fsw; AMBAO2=0.0 fsw, and; PBOVP=0.0 fsw),[8] the β matrix for fixed compartmental gas-exchange half-times ranging from 5 to 360 minutes was extracted from the NMRI98-prescribed profiles as described by Gerth and Johnson.[7] Results are given in Table 2.

Table 2
Extracted β for Single-Gas EL-RTA Approximation of NMRI98

Compartmental Half-Time (min)	Extracted β		
	M_0 (atm)	Slope, *a* (dimensionless)	Quadratic coefficient, *b* (atm^{-1})
5	1.39973E+00	6.23108E-01	2.58311E-03
10	1.30399E+00	1.14819E+00	-9.20122E-02
30	1.17811E+00	4.38442E-01	1.03625E-01
60	9.77048E-01	4.32245E-01	1.20903E-01
120	9.64614E-01	2.81518E-01	5.16181E-02
180	9.16596E-01	4.38031E-01	2.14822E-02
240	7.62125E-01	7.27216E-01	-7.59933E-02
300	8.68241E-01	6.59632E-01	-7.25568E-02
360	8.92189E-01	5.68320E-01	3.63199E-02

Eq. (2) was then used with the extracted β in Table 2 to produce the table of Maximum Permissible Tissue Tensions (PVALs) illustrated in units of fsw in Figure 3 for final parameterization of the EL-RTA.

Figure 3 includes the compartmental N_2 saturation line, which indicates the N_2 tension in each compartment when air-saturated at the indicated depth. For depths at which compartmental MPTT values fall below this line, the compartments eventually violate their MPTT values as they approach air-saturation at depth. If the ascent criteria of the EL-RTA are strictly enforced, the diver is unable to make any ascent without first pre-breathing oxygen after any such violation occurs. However, the NMRI98-prescribed profiles for such cases – the profiles to which the EL-RTA was fit to obtain these MPTT values – do not include oxygen pre-breathing before ascent. The present fitted MPTT table was consequently obtained under the presumption of first ascent at the end of the specified bottom time, regardless of the prevailing compartmental tissue tension - MPTT relationships. As a result, the appropriate schedule prescribed by the EL-RTA for such cases occurs with a forced ascent to first stop at the end of the specified bottom time, after which conventional EL-RTA ascent criteria apply. These features limit the applicability of the EL-RTA with the present XValSS_DISSUB7 MPTT table to cases in which oxygen is breathed throughout ascent.

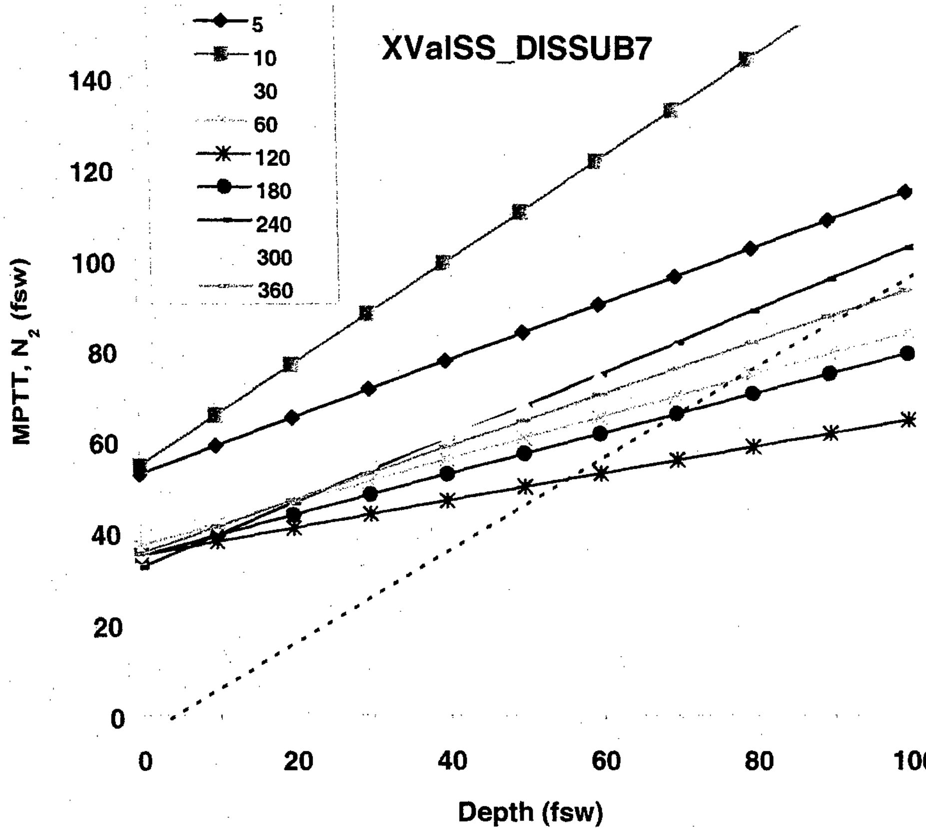

Figure 3. Maximum Permissible Tissue Tensions as functions of depth in the XValSS_DISSUB7 EL-RTA Model Parameter Input File. The dotted line is the compartmental N_2 saturation line. MPTT values below this line are prohibited in conventional implementations of the EL-RTA.

Decompression tables generated with the EL-RTA and the XValSS_DISSUB7 MPTT table are given in Appendix H. Table support for repetitive dives is extended up to bottom times at which part of the decompression is governed by a gas exchange compartment with half-time longer than 180 minutes; the half-time of the reference compartment adopted for the tables. Repetitive dives after longer bottom times must be computed directly with the algorithm. The Thalmann Algorithm Dive Planner for Windows, an implementation of the EL-RTA operated through a user-friendly graphics interface originally developed to accompany the Navy Dive Computer,[9] has been elaborated in Version 2.12 to support such calculations. Both the tables in Appendix H and schedules prescribed directly by the algorithm include a 15 min air-breathing break after each 60 min of oxygen breathing to mitigate the occurrence and severity of oxygen toxicity.[10]

MAN-TESTS OF SELECTED SCHEDULES

TRIAL DESIGN

Man-dives were completed to test the hypothesis that DCS incidence in selected dive profiles prescribed by the tables is not higher than some specific acceptable value. Practical constraints limited the number of man-dives that could be undertaken for testing to 128; a number too small to permit any statistically satisfying conclusion to be made about specific schedules within the tables. A sequential trial design was consequently adopted in which results from tests of a limited number of different schedules would be combined under the presumption that all tested schedules incur nearly the same DCS risk. The trial was conducted under rules that prescribed rejection of the entire table of schedules when results indicated with 95% binomial confidence that the true DCS risks of the tested schedules exceed 4% (Table 3).

TABLE 3
Number of DCS Cases on which to Reject at 95% Binomial Confidence that True DCS Risk Exceeds 4%

# DCS	Exposures
3	10-21
4	22-34
5	35-50
6	51-66
7	67-83
8	84-101
9	102-119
10	120-137

The rejection criteria in Table 3 pertained regardless of when in a profile DCS might have occurred. Advance through testing of the different profiles proceeded according to accumulated outcomes, with the outcome for each man-exposure classified as follows:

(1) Class I
- Mild pain or aching in the joint(s), not exceeding an intensity of 3 out of 10 and not associated with limitation of motion;
- Minor numbness or paresthesia without objective neurological findings;
- Moderate fatigue;
- Skin itching or erythema.

(2) Class II
- Pain or aching in the joint(s) greater than 3/10 or resulting in limitation of motion;
- Minor numbness or paresthesia with objective sensory findings;
- Minor motor weakness;
- Profound fatigue;
- Skin marbling;

- Class I symptoms that present while the diver is still under pressure.

(3) Class III
- Major numbness or paresthesia with objective sensory findings;
- Major motor weakness;
- Gait or balance disturbance;
- Vertigo;
- Hearing abnormalities;
- Visual disturbance;
- Disturbance of consciousness;
- Cognitive or psychomotor change;
- Mild to moderate substernal distress, cough and/or shortness of breath.

(4) Class IV
- Paralysis;
- Collapse;
- Loss of consciousness;
- Severe substernal distress, cough, and/or shortness of breath.

Occurrence of more than one Class III DCS case or any Class IV DCS case were additional criteria for rejection of a draft decompression table. The NEDU Senior Medical Officer was the sole judge of whether either of these criteria was met. Final determination of outcome classifications and continuance of testing was made by the NEDU Senior Medical Officer in consultation with the Principal Investigator.

The rejection rules not only limited the number of diver-subjects exposed to unnecessarily high DCS risk, but also determined the probability that a table with schedules of uniform true DCS risk would in fact be rejected. This probability was estimated for profiles of various true DCS risks using a Monte Carlo simulation of 50,000 exposures at each true DCS risk to generate the power curve for the prospective trial. Exposures in each simulated trial of 128 total man-dives were taken 8 man-dives at a time in accord with the planned conduct of the trial. Results are illustrated in Figure 4.

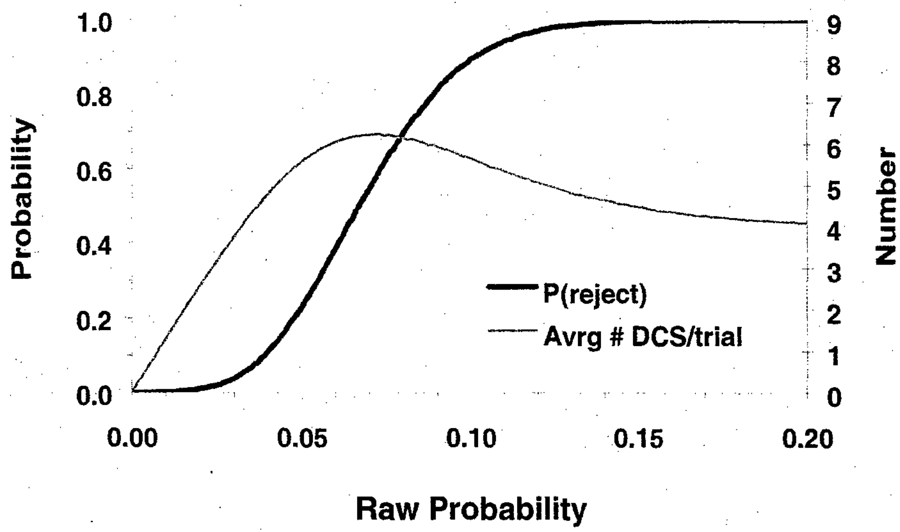

Figure 4. Power curve of the trial based on rejection rules in Table 3. Results of Monte Carlo simulations of 50,000 trials at each raw, or actual, risk. Each trial consisted of 128 exposures taken eight at time.

Data in Figure 4 indicate that if the true underlying risk of schedules in the table is 5%, the probability of rejecting the table in a trial of 128 exposures was 22.7%. Similarly, if the true underlying risk of schedules in the table is 10%, the probability of rejecting the table in a trial of 128 exposures was 89.3%.

SCHEDULE SELECTION

Eight profiles for man-testing were constructed from the depth/bottom time matrix in Table 4. Each profile consisted of two air dives to the same depth for the same bottom time, separated by a surface interval equal to the bottom time less the total decompression time of the first dive. The profiles consequently were considered to represent worst cases of personnel participating in alternating sorties of duration roughly equal to the tested bottom time.

Table 4
Test Profiles Matrix. Each marked cell indicates a test profile of two air dives to the indicated depth for the indicated bottom time, separated by a surface interval equal to the indicated bottom time less the total decompression time of the first dive.

		Depth (fsw)		
		30	40	60
Bottom Time (hr)	3		*	*
	4	*	*	*#
	6	*	*#	*#

The actual schedules tested are given in Table 5.

Table 5
Test Profiles

Profile #	Depth (fsw)	Bottom Time (min)	STOPS (fsw)* 50	40	30	20	10	TST (min)	Total Time Dive (min)	Total Time Profile (min)
1	40	180			17	14	21	52	238	
	0	127								
	40	180			25	14	60	99	285	650
2	60	180	30	12	12	5	63	122	308	
	0	56								
	60	180	34	12	12	29	82	169	355	719
3	30	240				20	23	43	291	
	0	196								
	30	240				24	58	82	330	817
4	40	240			30	13	51	94	342	
	0	145								
	40	240			33	13	57	103	351	838
5	60	240	46	11	2	38	75	172	420	
	0	66								
	60	240	47	11	1	53	83	195	443	929
6	30	360				32	58	90	462	
	0	269								
	30	360				33	69	102	474	1205
7	40	360			44	13	74	131	503	
	0	269								
	40	360			44	16	99	159	531	1303
8	60	360	60			74	98	232	604	
	0	126								
	60	360	60			102	89	251	623	1353

* Air-breathing breaks included in stop times (15 min air after every 60 min O_2, with O_2 breathing started at time leave bottom of every decompression); Stop times do NOT include travel time to stops.

Table 6 gives DCS risks of the selected profiles as estimated using two different probabilistic models of DCS incidence and time of occurrence.[4,5,11,12] Rebreathers contemplated to support actual DISSUB rescue operations, such as the MBS 2000 HOTP, fail to maintain inspired FO_2 at levels of 95% and above, but are more reliably expected to maintain inspired FO_2 at levels of 90% and higher.[2] Consequently, Table 6 also includes estimates of DCS risks of the profiles with the subjects assumed to breathe 90% O_2 during the on-O_2 periods of the decompressions. The reduction of FO_2 from 95 to 90% incurs noticeable but still-acceptable increases in DCS risk.

It can be noted that the first dive of each test profile has a counterpart in the US Navy Standard Air Decompression Table. Of these, the first dive in profiles marked with an "#" is a Standard Air exceptional exposure. In all cases, total decompression times for test profiles are often substantially longer than the decompression times of their Standard Air counterparts. This occurs despite 100% O_2 breathing during the test dive decompressions, and reflects the low intended DCS risk of the test profiles (*c.f.*, Table 6).

The overall pulmonary O_2 dose for each profile is also given in Table 6 in terms of Cumulative Unit Pulmonary Toxic Dose (CUPTD) units.[13] The anticipated oxygen dosages were comparable to those experienced during standard US Navy treatment protocols for decompression sickness and air embolism and were expected to be well tolerated by most subjects. Additionally, a 15 min air-breathing break was prescribed after each 60 min of oxygen breathing to mitigate the occurrence and severity of oxygen toxicity.[10] These air-breathing breaks are included in the schedules given in Table 5.

Table 6
Estimated Pulmonary Oxygen Doses and DCS Risks of Test Profiles

Profile #	Depth (fsw)	Bottom Time (min)	CUPTD*	P_{DCS} (%)					
				----- 95% O_2 decompression -----			----- 90% O_2 decompression -----		
				BVM(3)[9,10]		NMRI98[11,12]	BVM(3)		NMRI98
				conditional	cumulative	cumulative	conditional	cumulative	cumulative
1	40	180		0.32			0.41		
	0	127							
	40	180	253.9	0.63	0.95	0.84	0.86	1.27	1.09
2	60	180		0.37			0.46		
	0	56							
	60	180	630.9	1.16	1.53	1.84	1.69	2.15	2.49
3	30	240		0.33			0.40		
	0	196							
	30	240	176.6	0.61	0.94	0.64	0.77	1.17	0.82
4	40	240		0.52			0.66		
	0	145							
	40	240	338.0	0.91	1.42	1.16	1.21	1.87	1.60
5	60	240		0.61			0.76		
	0	66							
	60	240	805.5	1.55	2.15	2.51	2.20	2.94	3.44
6	30	360		0.62			0.77		
	0	269							
	30	360	260.6	0.93	1.54	1.22	1.15	1.91	0.52
7	40	360		0.92			1.71		
	0	269							
	40	360	459.9	1.32	2.22	2.16	1.48	2.87	2.88
8	60	360		1.28			1.60		
	0	126							
	60	360	1067.5	1.97	3.22	3.94	2.77	4.33	5.30

* Cumulative Unit Pulmonary Toxic Dose computed using the method of Harabin, *et al.*[13]

GENERAL PROCEDURES

The NEDU Committee for the Protection of Human Subjects reviewed and approved the Manned OSF Protocol[14] that was prepared to support the man-testing in this program. U.S. Navy trained military divers, who had given informed, written consent, served as diver-subjects. A detailed medical history for each subject was obtained by interview and questionnaire to acquire pertinent anthropometric and demographic data, medical and family history, smoking history, and a detailed diving history, including information about any prior cases of decompression sickness or oxygen toxicity. The subjects received baseline medical testing including a physical examination with emphasis on the pulmonary and nervous systems, pulmonary function studies, and a 2-D echocardiogram.

Prior to participating in the study, each diver-subject was trained in the use of the MBS 2000 HOTP and the planned dive procedures, including emergency procedures and the management of decompression sickness and oxygen toxicity.

A diver-subject was allowed to participate in more than one profile if, in addition to meeting all other constraints for participation, a minimum of one week (7 days) had elapsed between successive profiles, and pre-dive pulmonary function test results for the individual had returned to within acceptable limits of the individual's initial baseline values.

During the decompression and as required afterward, the diver-subjects were monitored clinically for signs and symptoms of oxygen toxicity and decompression sickness. If decompression sickness or significant symptoms of CNS oxygen toxicity occurred at any time during the decompression, the experimental decompression for the affected individual was aborted. The affected diver-subject was returned to the air environment, removed to an adjacent chamber, and recompressed and/or treated on air as needed. The remaining diver-subjects continued on the original decompression. If more than two diver-subjects manifested signs and symptoms suggesting DCS or CNS oxygen toxicity, it was planned to abort the experimental decompression for all diver-subjects, recompress them to the original bottom depth, and treat as needed. The entire team was then to be decompressed using USN Table 7.

If decompression sickness developed after surfacing, the affected diver-subject was treated in accordance with the U.S. Navy Diving Manual. Care was taken to monitor both the individual's oxygen dosage and tolerance to oxygen.

Early USN experiments with air saturation at depths 50 fsw and deeper[15] demonstrated that prolonged exposure to oxygen at partial pressures of 0.5-0.6 ATA (equivalent to air exposures at 50 and 60 fsw) sensitized divers to subsequent exposures to higher oxygen partial pressures. During excursion dives from saturation or with oxygen breathing during decompression from saturation, pulmonary symptoms and significant decreases in vital capacity occurred at oxygen exposures that would ordinarily be

considered innocuous. Because divers in the present profiles breathed air during the bottom times and were exposed to higher oxygen levels during the experimental decompressions, special provisions were implemented to detect development of pulmonary oxygen toxicity. Pulmonary oxygen toxicity has been studied principally with symptom reporting and pulmonary function studies. Spirometry, especially vital capacity (VC) is commonly used to measure oxygen effects.[16] Suzuki, et al., reported that diffusing capacity (DLco) and diffusing capacity referenced to lung volumes (DLco/V_A) were more sensitive to toxic effects of oxygen than VC.[17] The following Pulmonary Function Tests (PFTs) were performed on each diver-subject:

1. Forced vital capacity (FVC), forced expired volume in one second (FEV_1), maximum expiratory flow rate (FEV_{MAX}) and maximum mid-expiratory flow rate ($FEV_{25\text{-}75}$)

2. Diffusing capacity for carbon monoxide (DL_{CO}) by the single-breath method. Alveolar volume (V_A) was measured concomitantly using methane as the tracer gas. Hemoglobin and carboxyhemoglobin concentrations were measured by differential light absorption.

All diver subjects completed two pre-dive pulmonary function tests (PFTs) to measure baseline D_LCO, FVC, and related parameters. FVC was then measured within 2 hours of surfacing from the last dive in a profile. Both FVC and D_LCO were again measured two to four days thereafter. If the values in these second post-profile tests were not within the acceptable ranges of baseline, tests were repeated weekly until the values returned to within the acceptable ranges.

EQUIPMENT AND INSTRUMENTATION

All diving was conducted in the dry chambers of the NEDU Ocean Simulation Facility (OSF).

Ten MBS 2000 HOTPs were obtained to support requirements for diver-subject oxygen breathing during the decompressions. NEDU life support personnel performed all rig setup and maintenance. All CO_2 absorbent canisters were packed with 3.85 $\pm$ 0.04 lbs (1.75 $\pm$ 0.02 kg) of 408 mesh Sofnolime® absorbent (Molecular Products, Thaxed, Essex, UK). MBS 2000 HOTPs were supplied with 100% oxygen from the BIBS header at 130 psig over dive bottom pressure.

Each MBS 2000 HOTP was fitted with a locally fabricated gas sampling block on the inhalation hose to allow continuous sampling of diver inspired gas via a gas sampling port. The sampled gas flow was passed to the Medical Deck at 150, 200, 250, or 300 $\pm$ 15 ml(surface)/min, depending on chamber depth, for analysis of nitrogen, oxygen, and carbon dioxide fractions using a mass spectrometer (EXTREL, Pittsburgh PA). Two EXTREL mass spectrometers were used, with each monitoring four divers. Sample cycling from diver-to-diver on each XTREL was effected by advance of a line selector rotary valve. A period of 30 sec was allowed between each advance for line purging

and instrument settling. Thus, each MBS 2000 was sampled every 2 min. Inspired gas temperature in each MBS 2000 was also measured using a YSI model 731 temperature probe installed in the same gas sampling block, with output signal passed to the Medical Deck via electrical leads. The MBS 2000 inspired gas composition and temperature was displayed and logged in real-time on the Medical Deck with a computerized data acquisition system (DAS) under control of a LabVIEW (National Instruments Corporation, Austin, TX) data acquisition routine. Each computer-logged entry consisted of a time stamp and a reading of chamber pressure (depth, fswg) from a Druck pressure transducer on the Medical Deck connected to Alpha chamber. The record also included inspired gas content and temperature during decompression. The real-time record of Time, Depth [FIO_2, FIN_2, $FICO_2$, inspired gas temperature] was periodically interrupted with results of mass spectrometer calibration verification runs executed at Medical Deck Operator command before and after start of decompression from each dive. The data write rate to the real-time data file, and the record-by-record contents of each write, varied with time in the profile as schematized for a typical dive in Figure 5.

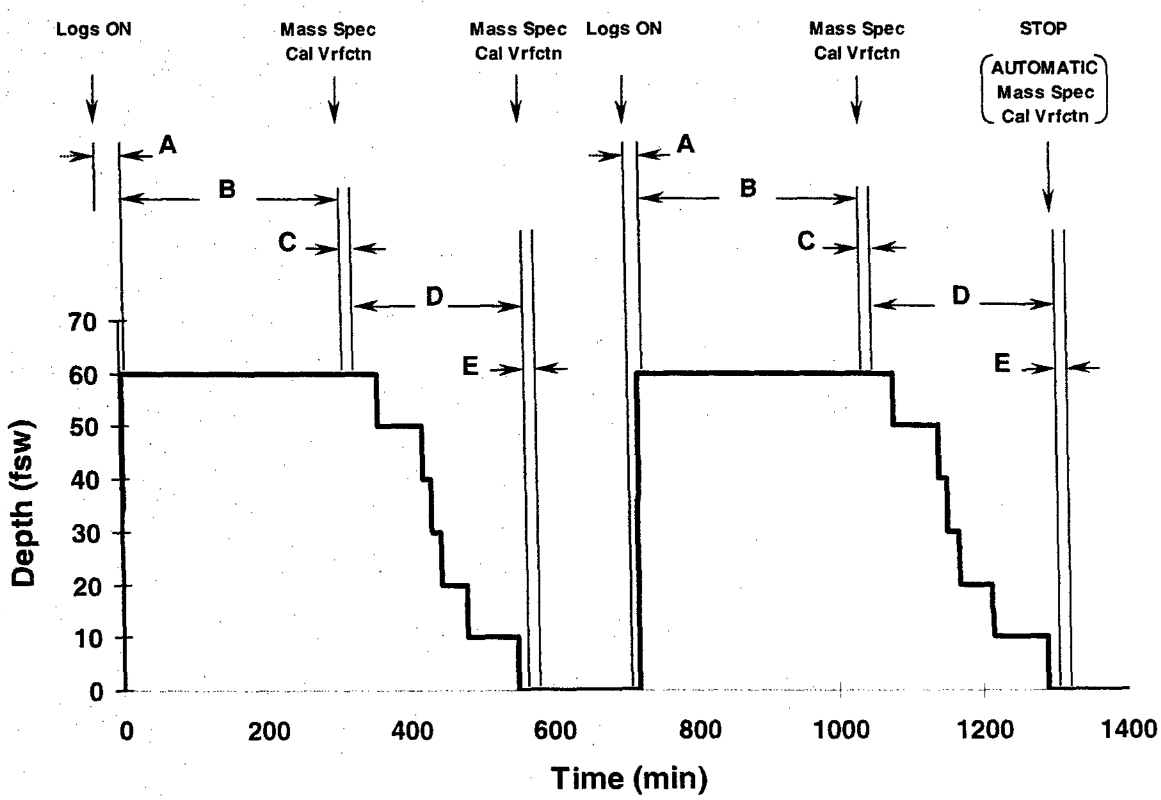

Figure 5. Data sampling schematic for a typical dive profile. Period-specific procedural details are given in accompanying Table 7. "Mass Spec Cal Vrfctn" indicates start of a mass spectrometer calibration verification run.

Table 7
Procedural Details for Data Sampling Periods Illustrated in Figure 5

Period	Procedural Description
Dive 1	
A	Period commences with Data Acquisition System (DAS) "Logs On" entry before compression: Depth recording @ 2 sec intervals.
B	15 min after "Logs On," system automatically switches to depth recording @ 30 sec intervals during entirety of Period B.
C	DAS "Mass Spec Cal Vrfctn" entry triggers a mass spectrometer calibration verification run during Period C: Depth recording is suspended.
D	On completion of the mass spectrometer calibration verification run, the DAS automatically switches to record depth and inspired gas temperature @ 2-sec intervals; FO_2, FN_2, and FCO_2 @ 2-min intervals; throughout decompression in Period D.
E	After arrival at surface, a DAS "Mass Spec Cal Vrfctn" entry triggers a mass spectrometer calibration verification run, followed by automatic "Logs off." DAS clock remains running for "Logs On" entry before next dive.
Dive 2	
	Above process A-D is repeated starting with a "Logs On" entry before first compression on next dive. The record is closed at the end of the second (and last) dive by a "STOP" command, which triggers an automatic mass spectrometer calibration verification run before shutting down the system.

Before start of the man-dive series, mass spectrometer responses to step changes in sampled N_2 fraction at the inlet of each gas sample line were characterized at inlet pressures from 10 to 60 fsw at 10 fsw increments, as described by Gerth and Johnson.[7] The data were used in post-dive analyses as described by the latter authors to correct recorded diver inspired gas composition data for latency and mass spectrometer response time.

A Hewlett Packard ® Sonus 1000 diagnostic ultrasound cardiovascular imaging system was used for 2-D echo recordings. This system, which has been used at NEDU in previous studies for detection of Venous Gas Emboli (VGE), has integrated audio-video recording capability.

Pre-dive baseline and post-dive follow-up PFTs were completed using equipment and procedures described in an accompanying report.

Oxygen Utilization

Oxygen utilization by diver-subjects during each decompression was determined from oxygen bank pressures and temperatures measured before and after the decompression. The quantity of oxygen in moles used by an individual over a period of time *t* at ambient pressure *P* and temperature *T* is

$$n = P\dot{V} \cdot t/RT, \tag{4}$$

where $\dot{V}$ is the volume rate of oxygen use at ambient conditions during the period, and R is the Gas Law constant. Assuming that $\dot{V}$ is constant and independent of pressure, the total moles of oxygen used in an entire decompression is the sum of the amounts used in successive time periods t_i at different pressures P_i:

$$n_\mathrm{T} = \sum_i n_i = \frac{\dot{V}}{RT}\sum_i P_i t_i \, . \tag{5}$$

Equation (5) is solved for $\dot{V}$ in units of L/min at temperature T to obtain:

$$\dot{V} = \frac{RT \cdot n_\mathrm{T}}{\sum_i P_i t_i} \, . \tag{6}$$

Eq. (6) was used to determine the mean volume rate of oxygen use by individuals during each decompression. The individual total oxygen use n_T was approximated with the mean oxygen use per individual as determined from the O_2 bank pressures and temperatures recorded before and after each decompression:

$$\overline{n}_T = \frac{V_{Bank}}{NR}\left(\frac{P_{Bank_1}}{T_{Bank_1}} - \frac{P_{Bank_2}}{T_{Bank_2}}\right) \tag{7}$$

where N is the number of diver-subjects in the decompression, V_{Bank} is the volume of the oxygen bank used to supply oxygen for the decompression, P_{Bank_1} and T_{Bank_1} are the bank pressure and temperature recorded before the decompression, and P_{Bank_2} and T_{Bank_2} are the bank pressure and temperature recorded after the decompression. Similarly, the $\sum_i P_i t_i$ term in Eq. (6) was approximated with the mean of the individual integrals determined from the recorded pressure and FIO_2 profiles of the participants. Only periods in which the recorded $FIO_2 > 0.3$ were included in the Pt integration for each individual in order to exclude air-breathing break periods and include only periods in which the individual was breathing on the MBS 2000 or open circuit oxygen.

Computed oxygen use rates include diver metabolic oxygen consumption, oxygen used to purge the MBS 2000 rigs, any other oxygen leakage that may have occurred when the divers were breathing from their rigs, and oxygen used by subjects aborted from the MBS 2000 and put on open circuit oxygen.

SPECIFIC DIVE PROCEDURES

Before the first dive of each profile, and prior to entering the OSF complex, the dive team consisting of seven or eight diver-subjects received a pre-dive brief from the Dive Watch Supervisor (DWS). Diver-subjects then filed to the dry chambers of the OSF (chambers A-E) for dive start. The OSF was compressed on air at a rate of 60 fsw/min to the target depth, which was maintained to within $\pm$ 0.5 fsw throughout the remainder of the planned bottom time. Bottom time began when the diver-subjects left the surface.

After divers reached bottom and completed system checks on each dive, diver-subjects completed the following exercise protocol during the next 40 minutes:

- Standing with a 10-lb barbell on the deck directly in front and to the side of each foot, bend at waist and knees, grasp one of the barbells in each hand, and stand erect.
- Complete 5 alternating-arm curls at approximately 2-sec intervals with the barbells in hand.
- Bend at waist and knees and set barbells back on the deck in their original position.
- Repeat once every 5 min.

Diver-subjects performed this exercise again during a 20-minute period as near before decompression start as possible. During the balance of the bottom time in each dive, the diver-subjects were free to engage in any activity deemed safe and unlikely to produce symptoms that could later be confused with decompression sickness or oxygen toxicity.

Approximately 30 minutes before end of the planned bottom time, a tender was locked into Echo chamber of the complex to assist the diver-subjects as necessary, and act as a safety observer during decompression. The tenders obtained responses to questions about MBS 2000 performance and monitored the diver-subjects for the presence or absence of DCS and oxygen toxicity symptoms and/or signs.

Oxygen breathing by each diver-subject during decompression was supported by an MBS 2000 HOTP supplied via the BIBS systems in Alpha and Bravo chambers. Fifteen minutes before the scheduled decompression start, the DWS shifted the BIBS gas in these chambers to 100% O_2. At the same time, the diver-subjects positioned themselves in Alpha and Bravo chambers on pre-assigned MBS 2000 HOTP units.

Before the diver-subjects donned their MBS 2000 for decompression, the DWS obtained the O_2 bank pressure and temperature from the Gas King for report to the Medical Deck. On reaching surface at the end of the decompression, the DWS again obtained the O_2 bank pressure and temperature for report to the Medical Deck to allow determination of the overall O_2 utilization by the diver-subjects during the decompression.

Divers were instructed to don their MBS 2000s three minutes before completion of the planned bottom time. With the slide valve closed on the MBS 2000, each diver continued

breathing ambient air by holding the MBS 2000 mask to prevent a seal to the face. As prompted by the DWS/inside tender, divers then completed the standard MBS 2000 purge procedure for starting O_2 breathing:

1) Exhale to residual volume and seal mask to face;
2) Open MBS 2000 slide valve;
3) Simultaneously press MBS 2000 overpressure relief and regulator purge valves for 30 sec;
4) Breathe normally for 30 sec;
5) Repeat steps (3) and (4) two more times.

Divers completed additional MBS 2000 purges during their O_2-breathing periods as directed by Medical Deck personnel when an individual's measured inspired FO_2 decreased to below about 85%. These additional purges simply entailed performance of step (3) above.

Decompression to the first stop at 30 fsw/min began at the end of the planned bottom time. Time zero for the O_2/Air cycling clock was at the onset of decompression from bottom depth.

Each hour of oxygen breathing was followed by a 15-minute air-breathing break. At the start of each air break period, MBS 2000 users closed their rig's slide valve and removed their MBS 2000 masks to breathe chamber atmosphere. The latter was vented with air as required to keep the chamber oxygen fraction in the 20-22% range throughout all dives, with the following exception: The oxygen fraction was allowed to reach but not exceed 25% during any decompression time that remained after the last scheduled air-breathing break in a dive. Air-break times were included in the schedules given in Table 5. The diver-subjects were questioned during each air-breathing break about the presence or absence of any symptoms of oxygen toxicity. At the end of the 15 minutes, the diver-subjects were instructed to don their MBS 2000 masks and complete the On-O_2 purge procedure. The time back on oxygen was logged as the time when all diver-subjects were back on the mask.

Diver-subjects were not allowed to eat or drink during oxygen breathing periods, but were allowed to eat snacks and drink non-carbonated fluids during the air breaks. Every effort was made to ensure the comfort of the diver-subjects during decompression.

If a subject could not remain on the MBS 2000 because of excessive inspired gas temperature, CO_2 buildup, or other rig malfunction, he/she was shifted to the BIBS mask while a backup MBS 2000 was prepared for his/her use. The diver shifted to that rig as soon as it was available. If the diver could not remain on the backup MBS 2000, he/she completed the remainder of the decompression on the BIBS mask.

Upon completion of the last scheduled stop, the diver-subjects were instructed to remove their MBS 2000 masks and breathe chamber air. They were then decompressed to the surface at 30 fsw/min.

Diver-subjects remained in the chamber complex during surface intervals between dives. After surfacing from the last dive in a profile, diver-subjects proceeded from the chambers on the OSF third deck to the Physiological Laboratory in NEDU Building 302 for medical examination and post-dive testing. Elevators were used to move from deck-to-deck in the OSF and Building 302 in this transit: use of stairs was prohibited.

If a diver-subject developed DCS after reaching the surface, he was treated according to Chapter 21, Volume 5, U.S. Navy Dive Manual, Rev 4. If symptoms of oxygen toxicity precluded the use of 100% oxygen during treatment, a 60/40 N_2O_2 mix was available as a treatment gas. Treatments were planned to take place in the OSF or the NEDU Treatment Chamber as determined by the DWO and DWS in consultation with the DWMO.

For 2-D echocardiographic testing, the diver-subject lay on a standard examination table in the left lateral position. A 2.5 MHz ultrasonic transducer probe was lubricated and applied to the left chest. The probe position and direction was adjusted to obtain an image that showed all four cardiac chambers (apical and parasternal short-axis views), and allowed the auditory signal to be received from the optimal position in the right atrium or ventricle. The image was scored for VGE according to the scale given in Table 8, adapted from Spencer,[18] Webb, et.al.,[19] and Eftedal and Brubakk.[20]

Table 8
2-D Echo Bubble Scores

Score	Description
0	Visual Image – No bubbles seen Auditory Signal – No bubbles heard
1	Visual Image – Rare (<1 per sec) transient bubbles seen Auditory Signal – Occasional signal heard (<1 per cardiac cycle)
2	Visual Image – Several discrete bubbles visible Auditory Signal – Frequent discrete bubble signals
3	Visual Image – Multiple bubbles present, but not obscuring image Auditory Signal – Bubbles in most cardiac cycles, but not obscuring heart sounds
4	Visual Image – Bubbles dominating image, may blur or obliterate chamber outlines ("white-out") Auditory Signal – Strong bubble signals in each cardiac cycle, may obscure heart sounds

During each examination period, VGE scores were assessed first with the diver-subject at rest, and then after each of a sequence of controlled movements of each extremity. The diver-subjects were blinded from the 2-D echo machine and Doppler audio signals to prevent their awareness of results from influencing appreciation of subtle symptoms.

All diver-subjects were first examined for VGE within 30 – 45 minutes of surfacing from the second dive in their profiles. Divers in whom no VGE were detected were not examined further. Divers in who exhibited VGE on first examination were examined only once again within 1.5 – 2.0 hours of the first examination.

During the 48-hr period immediately following surfacing from the last dive in a profile, diver-subjects were admonished from drinking alcohol and advised to refrain from any vigorous exercise including jogging, bicycling, and weightlifting.

RESULTS

One hundred twenty-seven (127) repetitive man-dives were undertaken by fifty-seven divers, the attributes of which are listed in Appendix A. Two divers were aborted from their profiles during the surface interval after their first dive for causes determined not to be associated with the preceding decompressions *per se*. As a result, a total of 125 repetitive man-dives were successfully completed. Dive profiles, dates dived, and participant divers are listed in Appendix B, with specific comments about DCS cases and other events.

The oxygen exposures in the decompressions caused measurable changes in pulmonary function in about one-third of the diver-subjects, but all changes resolved within one week. Results of the pulmonary function tests, presented in detail in an accompanying report,[21] indicate that the oxygen exposures associated with the tested decompressions incurred acceptable risks of only short-term pulmonary function deficits with no evidence of long-term changes.

DCS and VGE Outcomes

Three DCS cases occurred in the 125 completed exposures, yielding an overall observed DCS incidence of 2.4%. It can be asserted at 95% confidence that the overall DCS risk of the profiles is less than 6.9% under the null hypothesis that the observed DCS incidence was in fact the true DCS risk of the 125 exposures.

All three DCS cases occurred after completion of 60 fsw dive pairs. One Type II (Class III) case occurred after two 180-min dives to 60 fsw; one Type II (Class I) case occurred after two 360-min dives to 60 fsw, and one Type I (Class II) case occurred after two 240-min dives to 60 fsw.

None of the divers who developed DCS exhibited detectable VGE on first examination after surfacing and were consequently not monitored thereafter. However, 4 divers on profile 8 (60/360 - 60/360), 3 divers on profile 2 (60/180 - 60/180), and 3 divers on profile 7 (40/360 - 40/360) exhibited VGE during both initial and follow-up examinations. One of these divers from profile 2 also exhibited VGE during only the first examination

after completing profile 1 (40/180 – 40/180). A maximum VGE score of 3, associated with movement of an extremity, was attained in four of these cases (2 divers on profile 8, 1 diver on profile 7, and the one diver with VGE on profile 1).

MBS 2000 Performance and Oxygen Utilization

Recorded depth and inspired oxygen fraction profiles for all completed dives are given in Appendix D.

The depth and inspired oxygen fraction profiles for Diver 10 on profile #8 completed on 020801 is reproduced from Appendix D in Figure 6. The irregularity of the inspired FO_2 profile illustrates the difficulty that many divers experienced maintaining the desired FIO_2 of 90% with the MBS 2000. The small 5-L volume of the MBS 2000 makes the FO_2 it delivers very vulnerable to leaks. For example, the FO_2 falls precipitously with even a momentary break in the mask-face seal, and remains depressed with no further leakage until the rig is purged with O_2. As a result, many diver-subjects with less-than-ideal oxygen discipline required frequent purges to keep their inspired FO_2 at acceptable levels. The illustrated diver's eventual failure to achieve and maintain the desired inspired FO_2 in each decompression resulted in instructions to abort from the MBS 2000 and complete the decompressions on open circuit oxygen. Such aborts are evident in Figure 6 and the figures in Appendix D when the indicated diver inspired FO_2 is constant at 95%, the value arbitrarily assigned to the recorded FIO_2 when a diver was breathing open circuit oxygen.

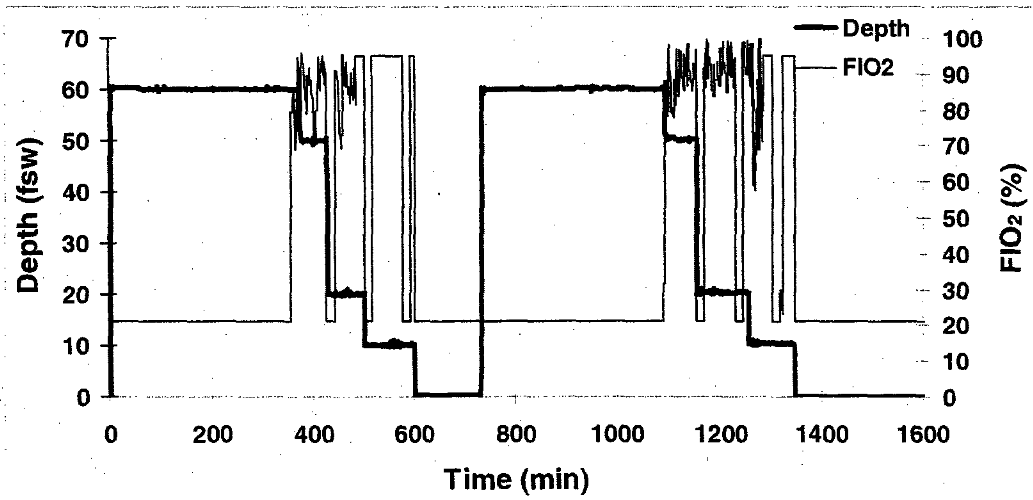

Figure 6. Depth and measured diver inspired FO_2 for profile 020801D06; DiverID 10.

Detailed data about oxygen use during the decompressions is given in Appendix C. Data from one decompression yielded a negative mean rate of oxygen use by participant divers, reflecting the relative imprecision of the method used to determine

oxygen utilization. Even with omission of this data from subsequent analyses, the mean oxygen use rate for each group of divers on a given profile ranged from 0.09 to 6.92 L(StdT) per min per diver. The overall mean oxygen use rate was 3.2 L(StdT) per min per diver. It should be noted that this figure is a liberal estimate of oxygen utilization by a diver breathing the closed circuit MBS 2000 because it includes contributions from divers breathing open circuit oxygen.

DISCUSSION

DCS Incidence Modeling Issues and Algorithm Applicability

The oxygen-accelerated decompression schedules developed in this work are based on the Thalmann Algorithm[8] parameterized with the NMRI98 Linear-Exponential Multi-Gas (LEM) probabilistic model.[4,5] The performance of NMRI98 and BVM(3), an alternative to NMRI98,[11,12] was evaluated on data beyond that used to calibrate these models and with particular relevance to air and N_2-O_2 decompressions in DISSUB rescue scenarios, including data from the man-dives completed in this program. The NMRI98 LEM model was also updated with this additional data to determine if its ability to handle oxygen-accelerated decompressions could be improved. Details of the analyses and the resultant updated LEM model, b105L3g, are given Appendix E.

Summary chi-square goodness-of-fit statistics[22] from data in Appendix E are given in Table 9. The P-value for a model on a composite data set in this table is the probability that differences between observed and model-estimated DCS incidences for the constituent data sets in each compilation are due to random variation alone. Low P-values indicate poor model correlation of observed DCS incidences and motivate rejection of a model.

Table 9
Chi-Squares of Probabilistic Models of DCS on Data Compilations*

Model	Data Compilation[+] NMRI98 (J=26)	BIG292 (J=21)	BIG105[#] (J=44)
NMRI98	**25.57 (P=0.375)**	19.65 (P=0.416)	362.66 (P=0.000) [67.05 (P=0.006)]
BVM(3)	23.39 (P=0.497)	**15.63 (P=0.682)**	516.53 (P=0.000) [74.66 (P=0.002)]
b105L3g	32.00 (P=0.127)	25.63 (P=0.141)	**90.15 (P=0.000)** [75.12 (P=0.001)]

*Values in **bold** are chi-squares for the models on their training data
[+]J = number of data sets in the compilation
= number of groups in the compilation chi-square
[#]Values in braces were obtained with omission of EDU1100.DAT from the chi-square

Each of three models gives a correlation of the observed DCS incidences in the BIG292 and NMRI98 training data sets with a chi-square P-value in excess of 12%, giving no motivation to reject the applicability of these models to these data. In comparison, none of the models yield a satisfactory P-value in application to the full BIG105 data set. Examination of the Pearson residuals for the models on the individual subsets of the BIG105 compilation (Appendix E) reveals that the EDU1100 data subset contributes inordinately to the overall chi-squares of the NMRI98 and BVM(3) models on this compilation. The EDU1100 data subset contains data for 182 oxygen-accelerated man-decompressions from air saturation that were completed to develop procedures for decompressing personnel rescued from a pressurized DISSUB.[1] Omission of the EDU1100 data subset from the chi-squares for the three models on BIG105 yields the more favorable values in braces in Table 9. This omission causes a smaller decrease in the chi-square for b105L3g than in the chi-squares for the other models, indicating that the performance of b105L3g on the EDU1100 subset is superior to that of the other models. However, the higher chi-squares and lower P-values of b105L3g on the NMRI98 and BIG292 subsets of BIG105 indicate that this superiority is obtained at the cost of generally degraded performance on the other data subsets in the compilation. The relatively long periods of oxygen breathing at depth in the EDU1100 data evidently invoke factors that none of these models consider and that distinguish the EDU1100 data from the rest in the BIG105 compilation. Significantly, Pearson residuals of all three models are comfortably low on the SRDRS-OTM data subset of BIG105, the data from the man-trials completed in the present study (Appendix E). The NMRI98 and BVM(3) models remain the models of choice for characterizing and controlling DCS risks of air and N_2-O_2 dives.

DCS risks of the man-dives completed in this program were estimated with the NMRI98, BVM(3), and b105L3g models from the measured depth and inspired oxygen fraction profiles in Appendix D. Results, which are given in Appendix F, compare favorably with the expected risks in Table 6 for assumed 90% FIO_2 during the oxygen breathing periods. Under the NMRI98 model, for example, the 1.73% mean cumulative DCS risk in actual dives was lower than the expected value of 2.27%. Similarly, under BVM(3), the 1.65% mean cumulative DCS risk in actual dives was lower than the expected value of 2.31%. With often-frequent oxygen purges performed as indicated by constant monitoring of diver inspired FO_2, the MBS 2000 provided adequate support of the oxygen breathing requirements of the presently tested schedules.

After completion of the man-trial of schedules in Table 5, an error in one of the EL-RTA software subroutines was discovered that caused air-breathing breaks to induce ascents with MVAL violations during some oxygen-accelerated decompressions. The error occurred whenever a breathing gas switch caused a compartment to start on-gassing from a starting gas tension in excess of its prevailing MVAL. The oxygen-accelerated air decompression tables in Appendix H were computed after this error was corrected.

The effect of the correction on estimated DCS risks of oxygen-accelerated decompressions from single air dives tabulated in Appendix H is illustrated in Figure 7. The correction caused either prolongation or insertion of decompression stops at deeper depths in the longer schedules of the tables, with little effect on the total decompression times of affected schedules. (These effects are illustrated for the test profiles in Appendix G.) The preponderance of the corrected schedules emerged with lower estimated DCS risks than their original counterparts, while the estimated DCS risk increases in the few remaining cases were insignificantly small (< 0.06%). The corrected schedules are consequently adopted in place of the originals.

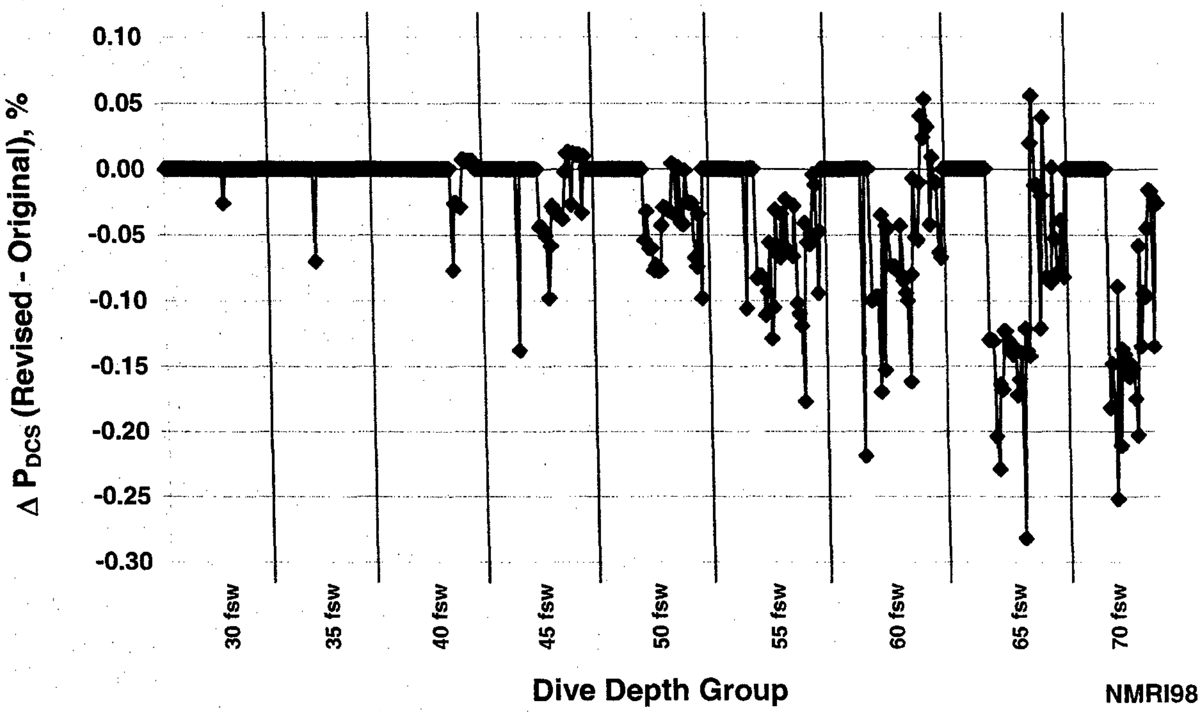

Figure 7. Effect of EL-RTA code correction on the estimated DCS risks of oxygen-accelerated decompressions for single air dives. Each point denotes the correction-induced change in the estimated DCS risk of one schedule. Points for different schedules are illustrated in order of increasing bottom time in each indicated dive depth group.

Figure 8 shows the raw estimated DCS risks of the single dive schedules in the corrected XValSS_DISSUB7 tables. It is evident that the mapping of NMRI98-prescribed schedules to the Thalmann Algorithm resulted in schedules that only poorly approximate the target uniform DCS risk of 1.5%. Nevertheless, the estimated DCS risks of the corrected schedules compare favorably with the estimated DCS risks incurred by tenders completing full USN Treatment Table 6 (USN TT6)[6] exposures (Table 10), and should therefore be acceptable for use in SRDRS operations.

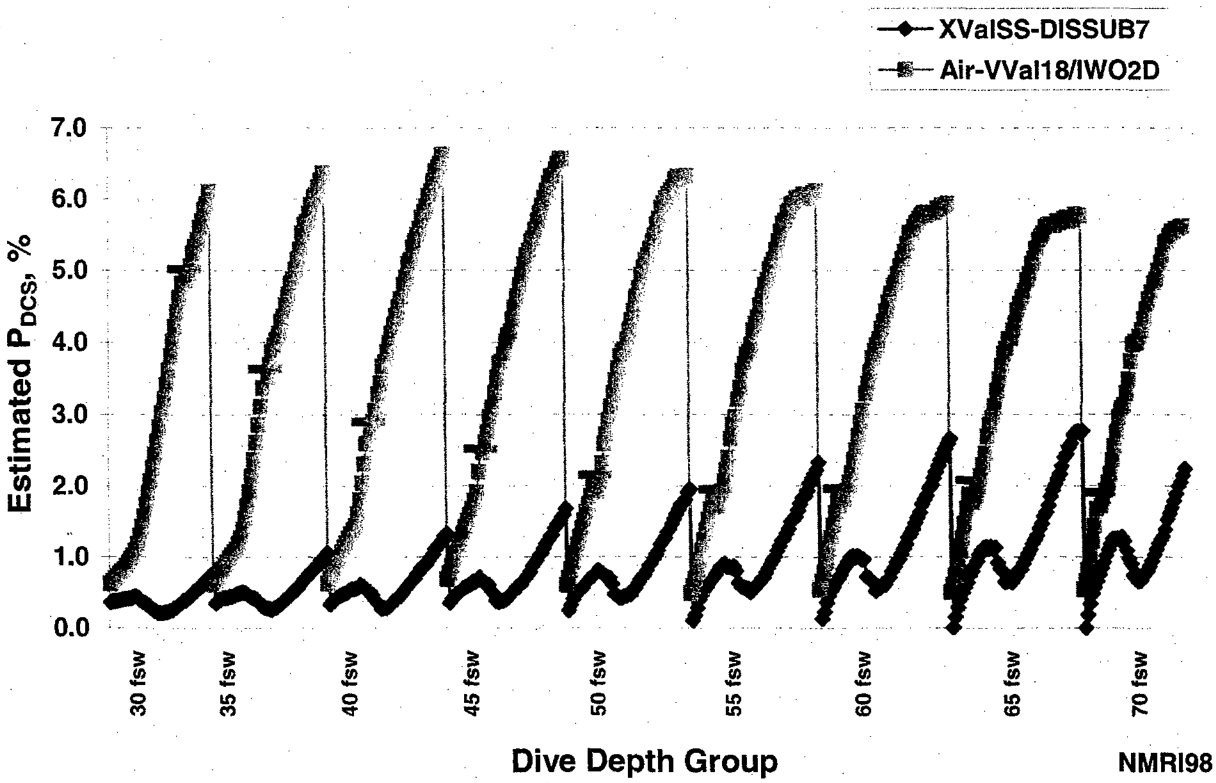

Figure 8. DCS risks estimated with the NMRI98 probabilistic model of single dive air schedules prescribed by the present tables (XValSS-DISSUB7) and by the Thalmann Algorithm VVal18 Air with In-Water Oxygen Decompression procedures (Air-VVal18/IWO2D). Each point denotes the estimated DCS risk of one schedule. Points for different schedules are illustrated in order of increasing bottom time in each indicated dive depth group. The no-stop limit for each dive depth group in the Air-VVal18/IWO2D schedules is indicated by a horizontal bar.

Table 10
Model-Estimated DCS Risks for Tenders in USN Treatment Table 6 Exposures

USN TT6 Tender Schedule	NMRI98 Predicted % DCS	Prediction Limits Low - High	BVM(3) Pred % DCS	Prediction Limits Low - High	CUPTD*
Standard	2.515	1.940 - 3.205	2.376	1.948 - 2.868	64.44
Fully Extended: 2 ext @ 60 fsw; 2 ext @ 30 fsw	1.887	1.475 - 2.380	1.890	1.515 - 2.329	230.68

*Cumulative Unit Pulmonary Toxic Dose computed with method of Harabin, *et al.*[13]

Concern that the Thalmann Algorithm XValSS_DISSUB7 schedules may be excessively conservative motivated Dr. E.T. Flynn at NAVSEA to propose use of Thalmann Algorithm VVal18 Air with In-Water Oxygen Decompression (Air-VVal18/IWO2D) schedules to support the decompression requirements of SRDRS PRM Operators and SDC Tenders.[23] Dr. Flynn computed these schedules with assumptions described by Chao, *et al.*,[24] and an earlier version of the EL-RTA software used in present work. Estimated DCS risks of single dive Air-VVal18/IWO2D schedules for the depth-bottom time combinations in Appendix H are shown with the estimated DCS risks of corresponding XValSS_DISSUB7 schedules in figure 8. The latter fall substantially below the estimates for their Air-VVal18/IWO2D counterparts, particularly for longer deeper exposures.

Specific Application to a Hypothetical DISSUB Rescue Scenario

A hypothetical timeline for rescue of 155 survivors from a DISSUB with an internal Equivalent Air Depth (EAD) of 60 FSW, and a rescue sortie time of 5 hours is illustrated in Table 11.[25] Sequential lock-in/lock-out procedures involving four two-man Tender teams are planned to maintain the presence of two Inside Tenders throughout each of the three rescuee decompressions in each SDC. Thus, a total of eight two-man Tender teams is required to support the two SDCs. If the Tender time for each SDC exposure is limited to two hours, each team must complete up to seven sorties in the SDC, separated by oxygen-accelerated decompressions to surface and appropriate surface intervals, in order to minimize operational manning requirements. Two sets of detailed schedules for the four teams supporting each SDC under this plan are given in Appendix I, along with model-estimated DCS risks of the various profiles. Tender decompressions in the first set (Figures I-1 and I-2, and accompanying Tables I-1 and I-2) are as prescribed by the present XValSS_DISSUB7 tables. Tender decompressions in the second set (Figures I-3 and I-4, and accompanying Tables I-3 and I-4) are as prescribed by the Air-VVal18/IWO2D procedures. Significantly, both sets of decompression prescriptions fit within the operational timeline. However, the estimated DCS risks associated with the XValSS_DISSUB7 decompressions are uniformly lower than those associated with the Air-VVal18/IWO2D decompressions.

Table 11
Hypothetical SRDRS Operations TimeLine

Elapsed Time (hr)	End Sortie #	SDC1 Rescuee Load (Total)	Deco Time (hr)	SDC2 Rescuee Load (Total)	Deco Time (hr)	Total # Rescuees Decompressed	Comments
5	1	16					STRT fill SDC1
10	2	29	0				SDC1 full; STRT DECO
15	3		5	16			STRT fill SDC2
20	4		10	29	0		SDC2 full; STRT DECO
22			12		2	29	END DECO SDC1
25	5	16			5		STRT fill SDC1
30	6	29	0		10		SDC1 full; STRT DECO
32			2		12	58	END DECO SDC2
35	7		5	16			STRT fill SDC2
40	8		10	29	0		SDC2 full; STRT DECO
42			12		2	87	END DECO SDC1
45	9	16			5		STRT fill SDC1
50	10	29	0		10		SDC1 full; STRT DECO
52			2		12	116	END DECO SDC2
55	11		5	10	0		Last Load SDC2
60			10		5		
62			12		7	145	END DECO SDC1
65					10		
67					12	155	END DECO SDC2

CONCLUSIONS AND RECOMMENDATIONS

Decompression tables for oxygen-accelerated decompressions from repetitive sub-saturation air dives have been developed based on a deterministic algorithm parameterized with a probabilistic model of DCS occurrence. Eight two-dive profiles constructed with this algorithm were tested in 125 man-dives, yielding an overall DCS incidence of 2.4% (3 DCS/125 man-dives). The three DCS cases observed in these tests occurred on profiles with dive pairs to 60 fsw. One case was a relatively severe Type II DCS incident.

The algorithm and decompression tables computed with the algorithm provide means to prescribe relatively low DCS risk alternatives to other available procedures for managing repetitive hyperbaric exposures of PRM Operators and SDC Tenders in SRDRS operations. However, algorithm and table use, particularly to prescribe decompressions from long deep repetitive dives, should be monitored closely for occurrence of DCS cases of severity unacceptable for PRM Operators and SDC Tenders in SRDRS operations.

Version 2.12 of the Thalmann Algorithm Dive Planner for Windows, an implementation of the Thalmann Algorithm operated through a user-friendly graphics interface originally developed to accompany the Navy Dive Computer, has been elaborated to compute the full range of EL-RTA(XValSS_DISSUB7) oxygen-accelerated decompression schedules in the tables appended to this report, as well as schedules for repetitive dives that exceed the scope of these tables. The Dive Planner also supports calculation of Air-VVal18/IWO2D schedules. Use of the Dive Planner to compute either XValSS_DISSUB7 or Air-VVal18/IWO2D decompressions is preferred over use of the respective tables, particularly for repetitive dives.

The ability of the Dive Systems International MBS 2000 Hyperbaric Oxygen Treatment Pack to support the oxygen breathing requirements of oxygen-accelerated decompressions was evaluated during the man-dives completed in this program. The MBS 2000 was found able to support such decompressions, but diver inspired FO_2 could be maintained above about 85% only with relatively frequent oxygen purges of the unit. The low volume of the MBS 2000 makes the FO_2 delivered by the unit highly vulnerable to even momentary leaks or breaks in the mask-face seal. Because such events occur unpredictably, maintenance of inspired FO_2 at desired levels by the MBS 2000 as configured for this study is ensured only with constant monitoring of diver inspired oxygen fraction.

The frequent oxygen purges required with MBS 2000 use caused the overall measured oxygen utilization rate during each decompression to average 3.2 L/min man. This rate far exceeded the resting metabolic oxygen consumption rate of 0.5 - 0.75 L(STP)/min. This utilization rate will be reliably reduced only by modification of the face-mask O_2 delivery system of the MBS 2000 to reduce the incidence of momentary leaks and intrusions of ambient air.

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APPENDIX A

Diver Attributes

Diver ID #	AGE (yr)	HT (in)	WT (lb)	Waist (in)	Neck (in)	# Profiles Dived
1	34	68.0	225.0			1
2	46	71.0	192.0	39.0	17.0	3
3	31	69.0	165.0			4
4	33	69.0	185.0			1
5	27	67.0	161.0			4
6	35	69.0	155.0	33.0	13.0	4
7	35	69.0	185.0	32.0	16.0	1
8	49	70.0	195.0			2
9	40	72.0	179.0	34.0	16.0	1
10	31	70.0	170.0			3
11	39	75.0	200.0	34.0	16.3	2
12	42	69.0	180.0	34.0	15.5	1
13	38	70.0	179.0			4
14	39	70.0	215.0	38.0	18.0	2
15	38	69.0	182.0	34.0	15.0	3
16	35	68.0	189.0			1
17	32	68.0	182.0	34.0		2
18	29	69.0	187.0	36.0	17.5	1
19	37	68.0	180.0	36.0	16.5	2
20	42	69.0	188.0	40.0	17.0	1
21	37	72.0	237.0			3
22	44	71.0	192.0			2
23	37	74.0	175.0	34.0	14.5	2
24	42	73.0	190.0	33.0	16.0	2
25	32	73.3	208.5	34.0	16.0	3
26	39	71.0	179.0	34.0	16.0	2
27	32	72.0	178.0	34.0	15.8	2
28	27	70.0	188.0	36.0	16.0	2
29	31	69.0	145.0			3
30	33	69.0	185.0	34.0	15.5	1
31	42	72.0	205.0	38.0	16.5	3
32	39	71.0	190.0	33.0	16.5	1
33	38	69.0	161.0	34.0	15.0	1
34	33	72.0	190.0			1
35	30	74.0	215.0	37.0	17.5	4
36	41	70.0	173.0	31.0	15.0	1
37	33	70.3	227.5	40.0	17.0	3
38	45	68.0	161.0			2
39	39	58.0	165.0	33.0		3
40	40	72.0	175.0			4
41	36	66.0	198.0	38.0	19.0	1
42	39	72.0	207.0	38.0	17.5	4
43	29	72.5	171.5			4
44	34	71.0	200.0	36.0	17.5	1
45	35	76.0	245.0	39.0	17.5	1
46	45	72.0	200.0			1
47	44	72.0	195.0	36.0	16.0	2
48	31	69.0	168.0	33.0	16.0	1

Diver ID #	AGE (yr)	HT (in)	WT (lb)	Waist (in)	Neck (in)	# Profiles Dived
49	31	68.0	175.3			3
50	30	73.0	205.0	35.5	15.5	1
51	31	72.0	195.0	35.0	16.0	4
52	39	69.0	195.0	33.0	16.0	3
53	35	70.0	161.0	32.0	15.0	3
54	32	70.0	178.0	32.0	15.0	1
55	33	69.0	175.0	35.0	16.0	1
56	44	67.0	189.0	37.0	16.5	5
57	43	64.0	175.0	36.0	16.0	3

APPENDIX B

SPECIFIC COMMENTS ON DIVES PERFORMED

DIVE DATE	PROFILE #	Diver ID #	COMMENTS
07/25/02	072502 (1)	53 26 43 31 5 25 51 15	
07/30/02	073002 (1)	52 3 6 23 57 40 21 13	
08/01/02	080102 (8)	30 56 19 35 10 55 28 14	Diver 30 presented on morning of 080502 with numbness in palmar area at base of thumb on left hand (approximately quarter-sized area, 2 x 2.5cm, involved). No objective findings on neurological examination. USN TT6 administered with 90% relief reported at end first O_2 period, 100% relief at end of second O_2 period. Diver reported following day claiming return of numb sensation, same location but reduced to about dime-sized (2 x 1.5 cm) area. USN TT9 administered twice on 080602: 1st LS @ 0857 w/ approx 70% relief overall; 2nd LS @ 1325 w/ approx 50% improvement after first O_2 period and no further improvement thereafter. Diver was examined the next day, at which time he reported SX had completely resolved.

DIVE DATE	PROFILE #	Diver ID #	COMMENTS
08/06/02	080602 (2)	25 49 39 47 2 50 44 37	* Diver 50 reported only one bag of MBS 2000 inflating at 2 minutes into first stop of first dive. One minute later, reported that both bags were inflating normally. Diver then reported feeling nauseous approximately 16 min later (18 min into first stop). Diver instructed to breathe chamber air, and reported almost immediate partial relief of Sx w/ continued improvement 2 min later. Diver put back on MBS 2000 but reported return of nausea within 10 min. Diver placed on chamber air, extracted to Delta chamber to complete the experimental decompression independent of remaining divers after making up lost O_2 time (See profile). Diver 50 pulled from profile during surface interval. Concluded after post-dive interview that diver had over-breathed the MBS 2000 (diver has pulmonary vital capacity of approx. 6.5 L); Sx not O_2 toxicity. * Diver 44 reported a sensation of pain and discomfort in a band-like distribution at the level of the umbilicus approximately 1 hr 45 min after surfacing from the second dive; the pain and discomfort were most pronounced on left side of back. Also reported bout of dizziness, but experiences slight dizziness from time-to-time probably due to regularly-taken anti-hypertensive medication. Examination otherwise normal except for absence of the two inferior superficial abdominal reflexes. Treated with USN TT6; reported complete relief of SX on descent.
08/08/02	080802 (8)	3 6 40 21 13 52 22 53	

DIVE DATE	PROFILE #	Diver ID #	COMMENTS
08/13/02	081302 (7)	43 19 10 56 8 27 35 9	
08/15/02	081502 (2)	29 51 47 42 24 26 32 25	
08/20/02	082002 (3)	4 57 5 40 21 13 11 52	
08/22/02	082202 (7)	37 29 28 35 54 39 10 56	
08/27/02	082702 (3)	46 31 42 15 5 2 48 53	

DIVE DATE	PROFILE #	Diver ID #	COMMENTS
08/29/02	082902 (5)	6 38 17 7 23 3 22 24	Diver 23 reported being awakened at approx. 0830 the morning after last surfacing by pain in the right knee: Gd 4/10; constant and diffuse. Neurological exam normal and lungs clear, but diver noted significant substernal burning post-dive. USN TT6 started 0945 083002. Complete relief of SX within 5 minutes of arrival at 60 fsw; TT backed off to TT5 due to rapid relief of SX and desire to minimize further pulmonary O_2 toxicity SX. TT5 completed w/2 extensions @ 30 fsw. Diver surfaced w/no remaining complaints. Post-TX neurological exam WNL.
09/04/02	090402 (6)	16 39 49 14 34 8 56 5	
09/06/02	090602 (4)	27 43 35 51 2 1 42	(Note only 7 subjects participated in this dive)
09/10/02	091002 (4)	6 33 3 36 38 45 13 57	Diver 6 reported shoulder pain during 20 fsw stop in first dive. The diver completed the dive normally and was aborted from the profile during the ensuing surface interval. Diver's Sx resolved spontaneously thereafter. Diver noted having slept in awkward position night before the dive. Incident diagnosed NOT DCS.
09/12/02	091202 (5)	29 17 11 49 56 20 15 18	

DIVE DATE	PROFILE #	Diver ID #	COMMENTS
09/17/02	091702 (6)	41 43 40 51 42 37 12 31	

APPENDIX C

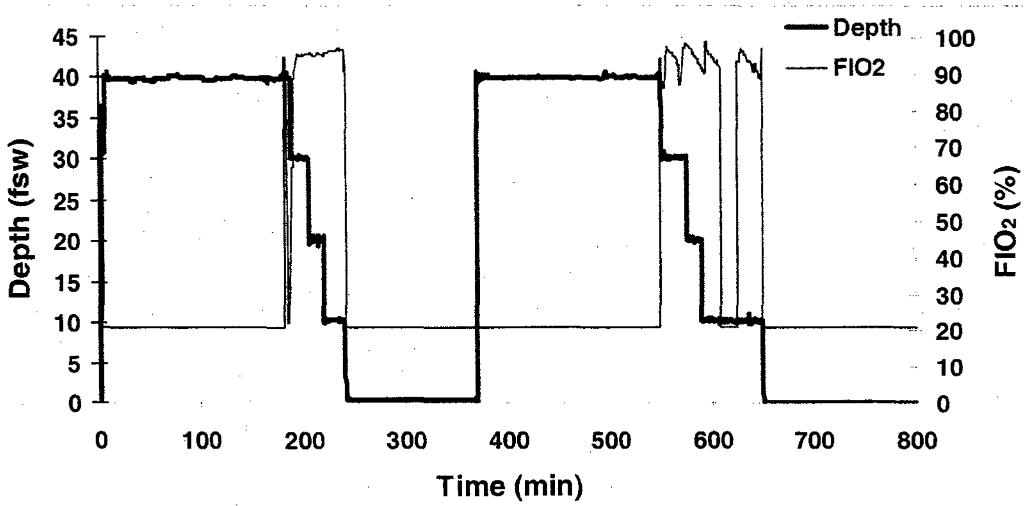
Oxygen Utilization During Decompression

Dive Date (YYMMDD)	Profile	Dive #	# Divers	Mean Integral(P*t) ON-O_2 (FIO2>0.3)	O_2 Bank P, T; V = 2228.54 L — P_1 (psia)	T_1 (°C)	P_2 (psia)	T_2 (°C)	n_T (moles/Diver)	V [L(STP)/Diver]	$\dot{V}$ [L(StdT)/min·Diver]
020725	1	1	8	98.958							
		2	8	133.617	1374.7	33.3	1354.7	29.4	1.95	43.75	0.33
020730	1	1	8	87.770	1334.7	30.0	1314.7	25.6	0.33	7.49	0.09
		2	8	137.854	1314.7	33.9	1294.7	28.3	-2.90	-65.06	-0.47
020801	8	1	8	361.211	1264.7	27.8	1154.7	25.6	77.85	1744.84	4.83
		2	8	364.892	1124.7	23.3	1024.7	23.3	77.92	1746.37	4.79
020806	2	1	8	217.198	964.7	31.7	914.7	34.4	44.16	989.63	4.56
		2	8	255.165	874.7	36.1	784.7	28.3	52.11	1167.87	4.58
020808	8	1	8	342.328	764.7	33.9	694.7	25.6	38.09	853.61	2.49
		2	8	377.297	694.7	25.6	634.7	22.2	40.87	915.87	2.43
020813	7	1	8	192.133	644.7	34.4	614.7	33.9	21.70	486.27	2.53
		2	8	206.177	604.7	26.1	564.7	25.6	30.07	673.89	3.27
020815	2	1	8	205.780	584.7	33.9	524.7	31.1	41.54	931.02	4.52
		2	8	256.538	524.7	31.1	474.7	25.6	31.26	700.62	2.73
020820	3	1	8	69.428	474.7	31.7	464.7	33.3	9.49	212.79	3.06
		2	8	102.057	454.7	28.3	434.7	27.2	14.09	315.87	3.10
020822	7	1	8	190.128							
		2	8	208.518							
020827	3	1	8	68.379	1614.7	33.3	1614.7	35.7	9.20	206.11	3.01
		2	8	103.192	1574.7	27.8	1524.7	26.1	31.87	714.19	6.92
020829	5	1	8	276.647	1574.7	32.8	1524.7	32.2	35.66	799.28	2.89
		2	8	300.165	1474.7	25.6	1394.7	23.9	55.82	1251.06	4.17
020904	6	1	8	115.167	1354.7	35.6	1344.7	36.1	9.29	208.24	1.81
		2	8	129.038	1284.7	25.6					
020906	4	1	7	112.239	1244.7	30.6	1214.7	32.8	33.75	756.43	6.74
		2	7	117.688	1204.7	28.9	1194.7	27.8	4.89	109.49	0.93
020910	4	1	8	154.061	1054.7	31.1	1054.7	32.8	4.36	97.78	0.63
		2	8	147.492	1034.7	27.8	1014.7	27.8	15.35	344.12	2.33

Dive Date (YYMMDD)	Profile	Dive #	# Divers	Mean Integral(P*t) ON-O_2 (FIO2>0.3)	O_2 Bank P, T; V = 2228.54 L P_1 (psia)	T_1 (°C)	P_2 (psia)	T_2 (°C)	n_T (moles/Diver)	V [L(STP)/Diver]	$\dot{V}$ [L(StdT)/min·Diver]
020912	5	1	8	270.906	1024.7	33.3	974.7	33.3	37.69	844.70	3.12
		2	8	307.090	944.7	26.7	884.7	25.6	43.70	979.34	3.19
020917	6	1	8	113.164	914.7	35.6	854.7	26.1	24.72	553.93	4.89
		2	8	134.203	854.7	26.1	834.7	25.6	14.24	319.17	2.38
										Mean =	3.20

APPENDIX D

INDIVIDUAL DIVE DEPTH AND INSPIRED FO_2 PROFILES OF DIVES COMPLETED



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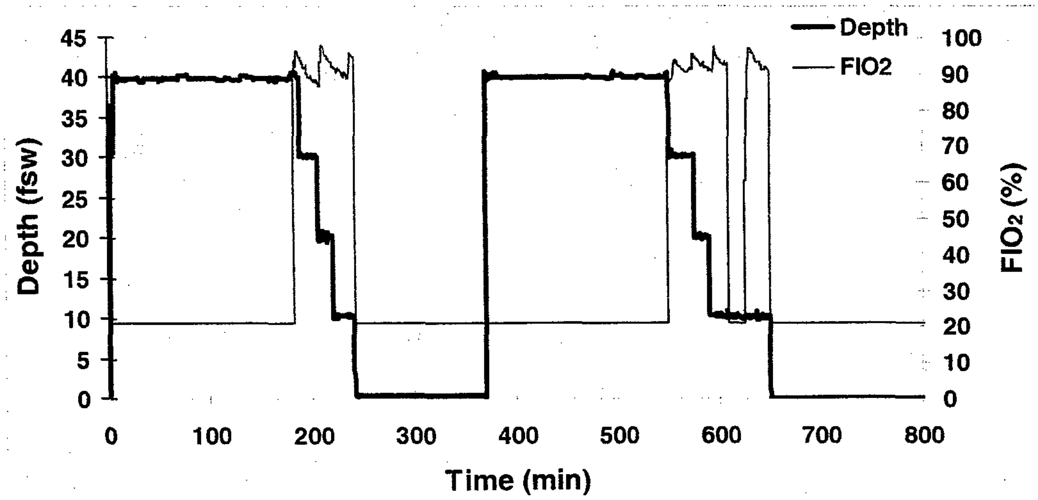

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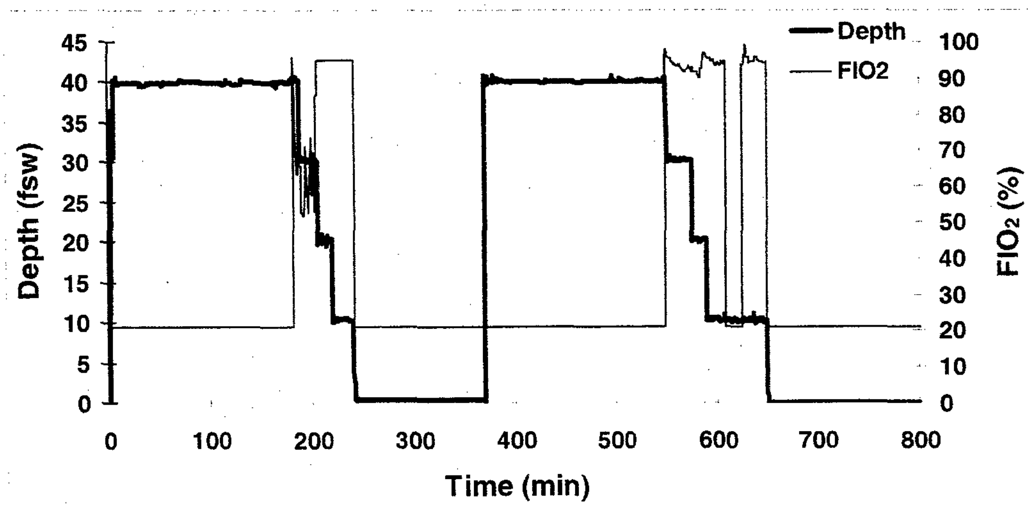

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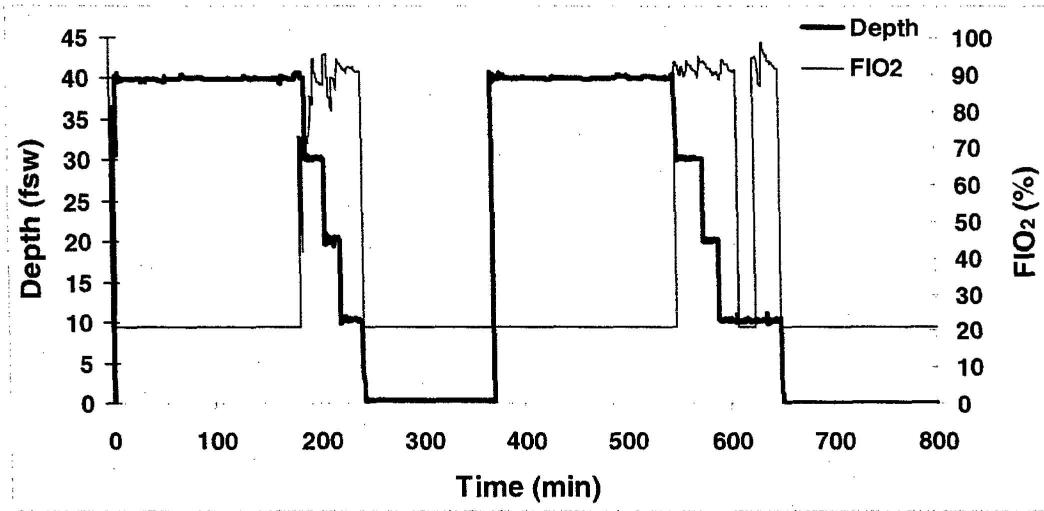

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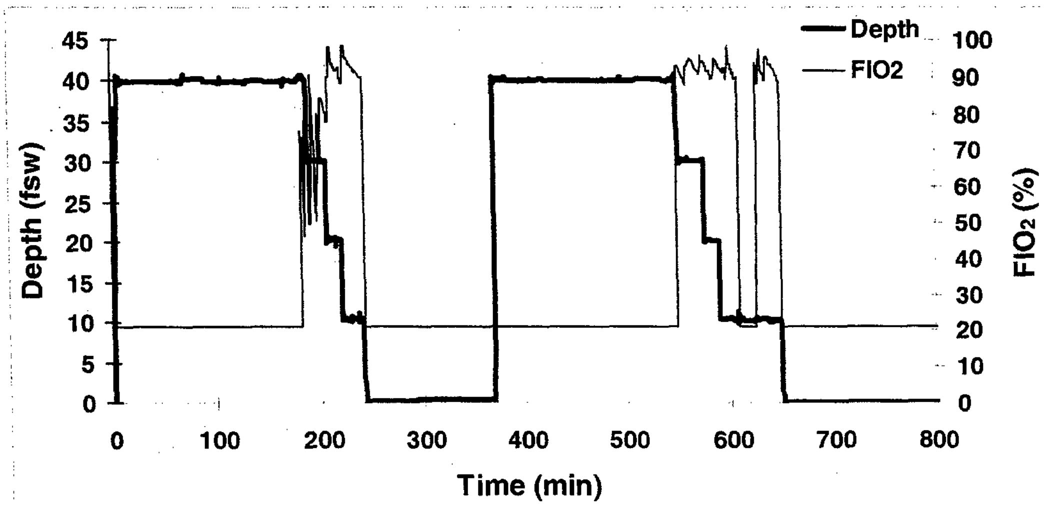

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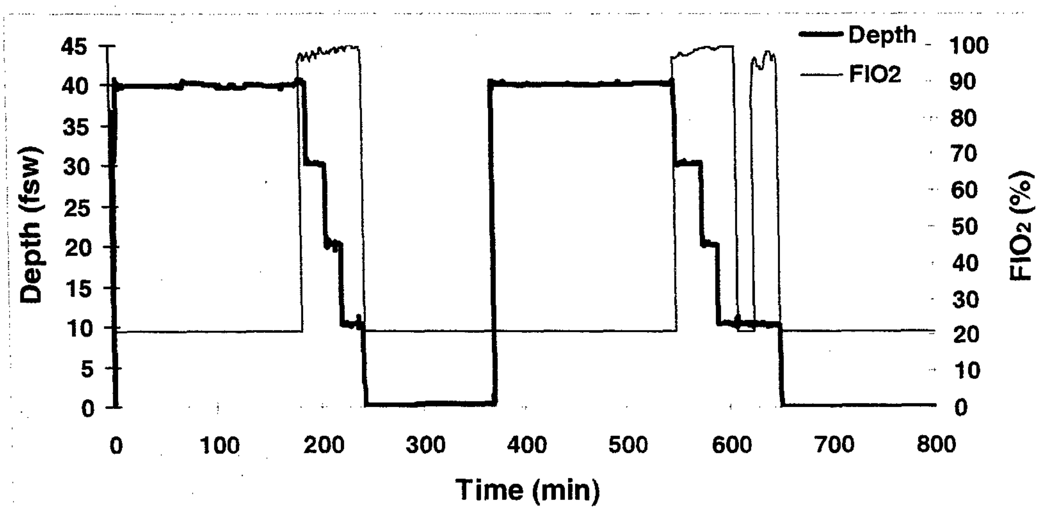

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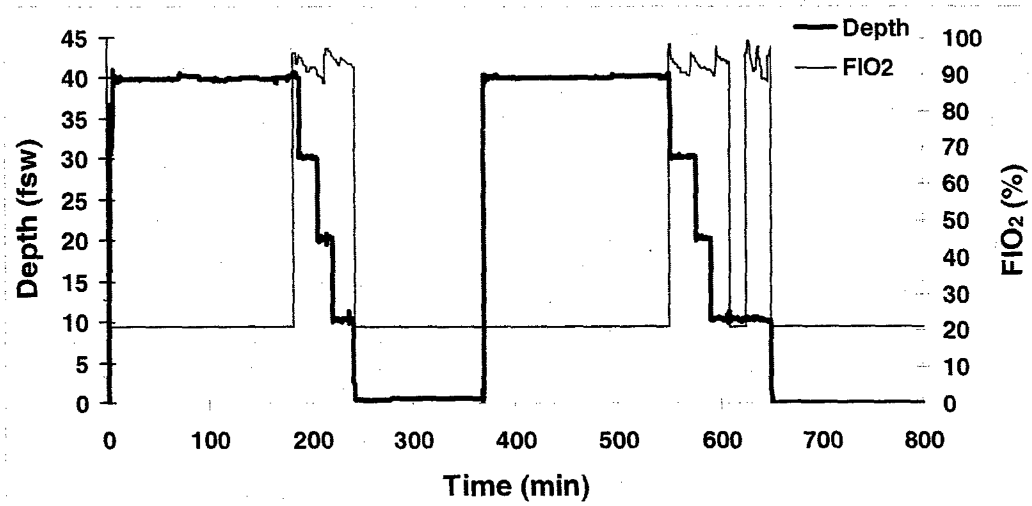
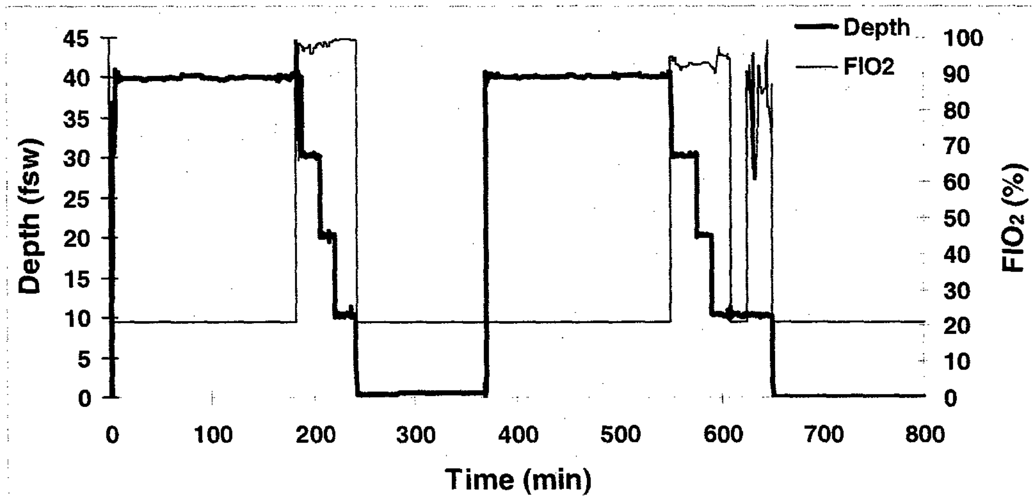


Profile 020725D08; DiverID 51



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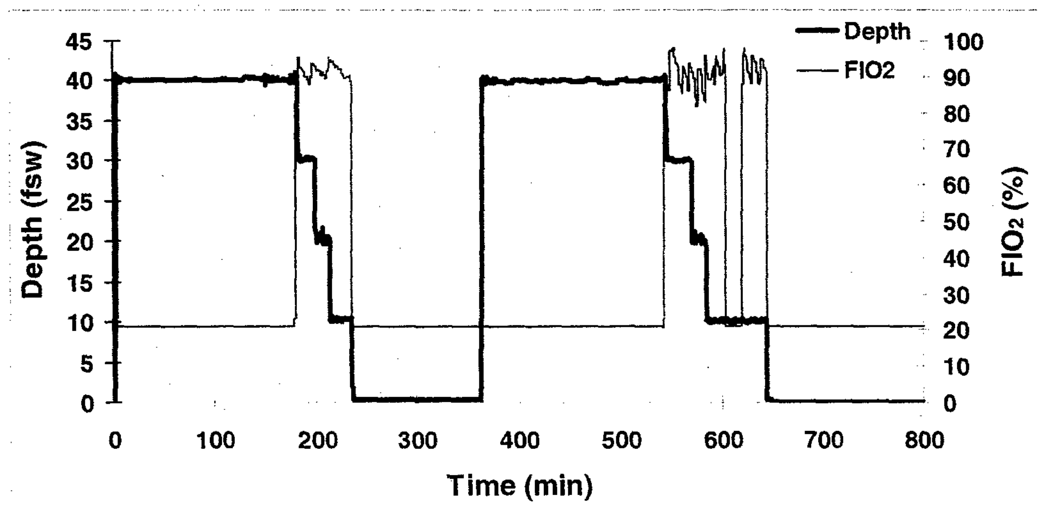

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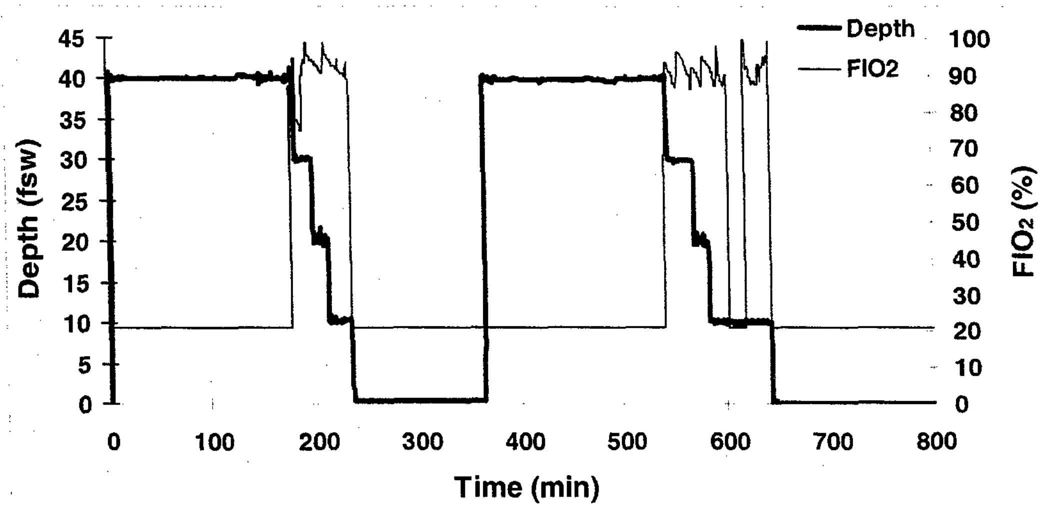

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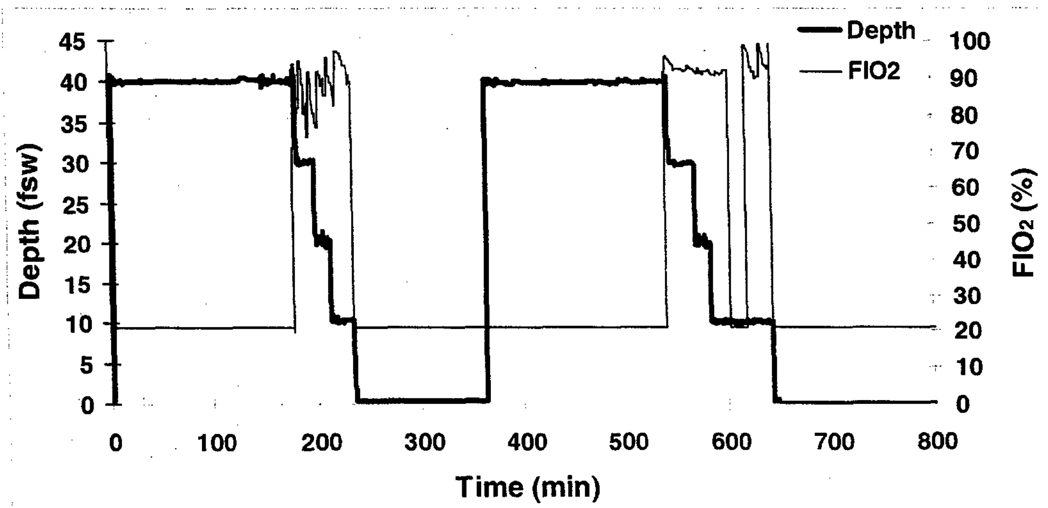
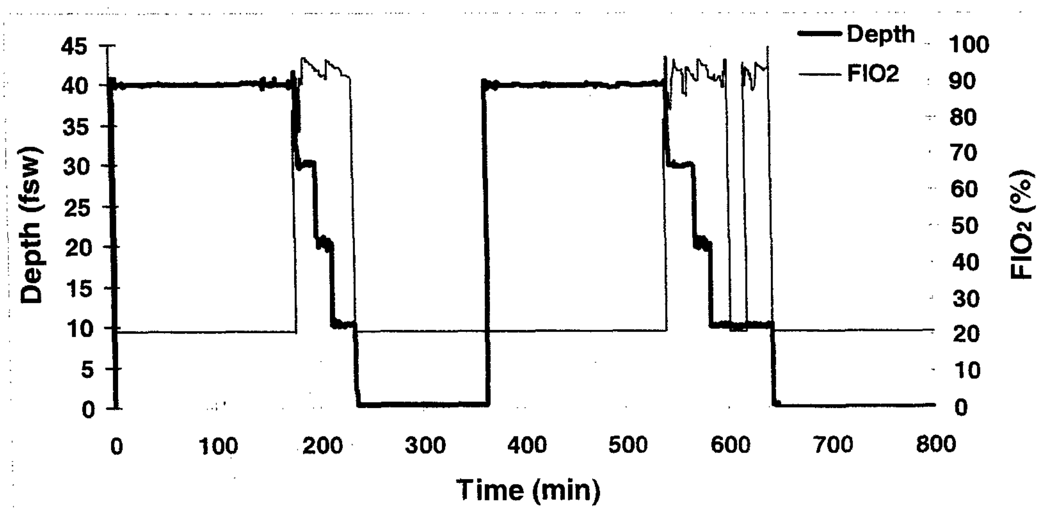


Profile 020730D03; DiverID 6



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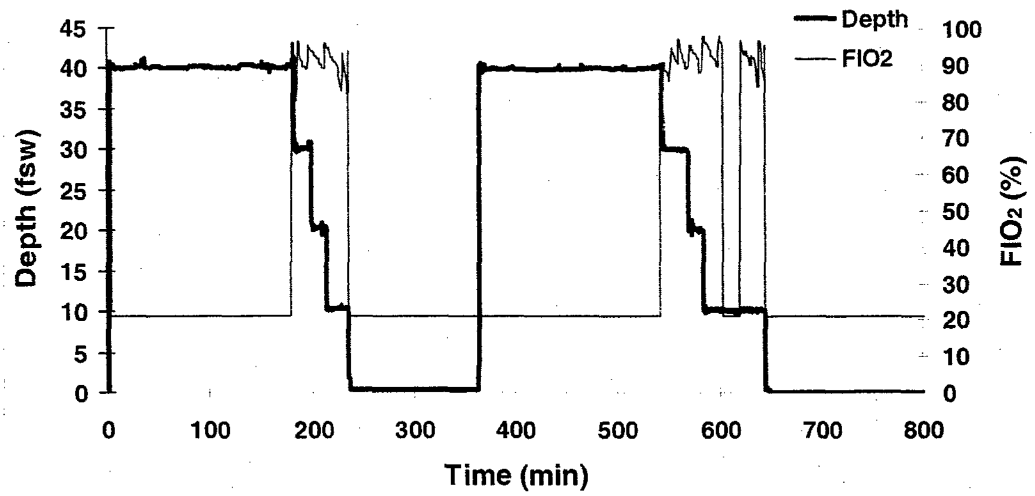
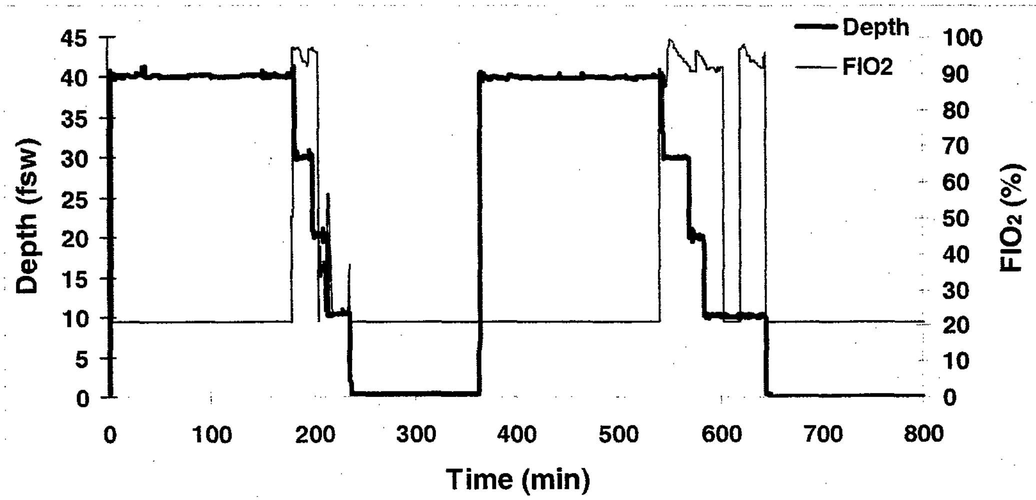


Profile 020730D06; DiverID 57



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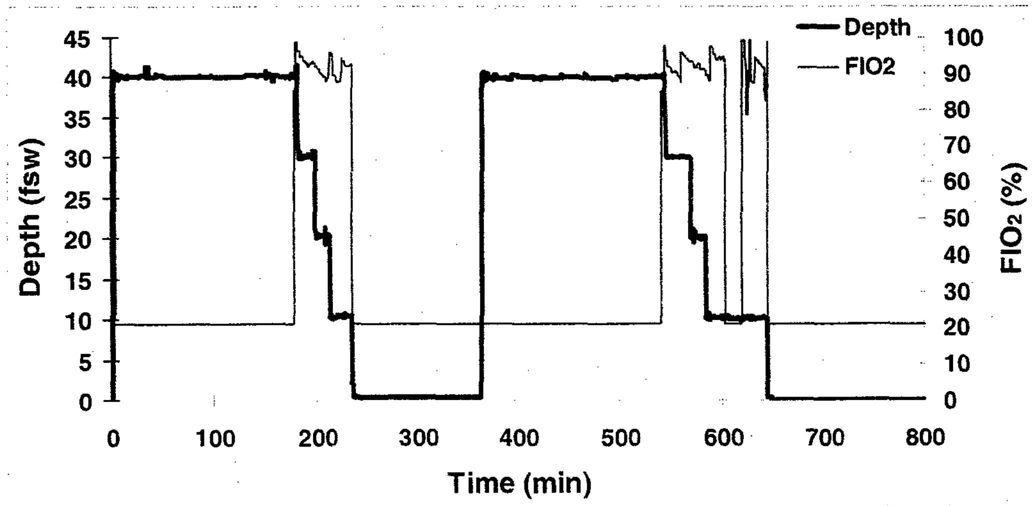

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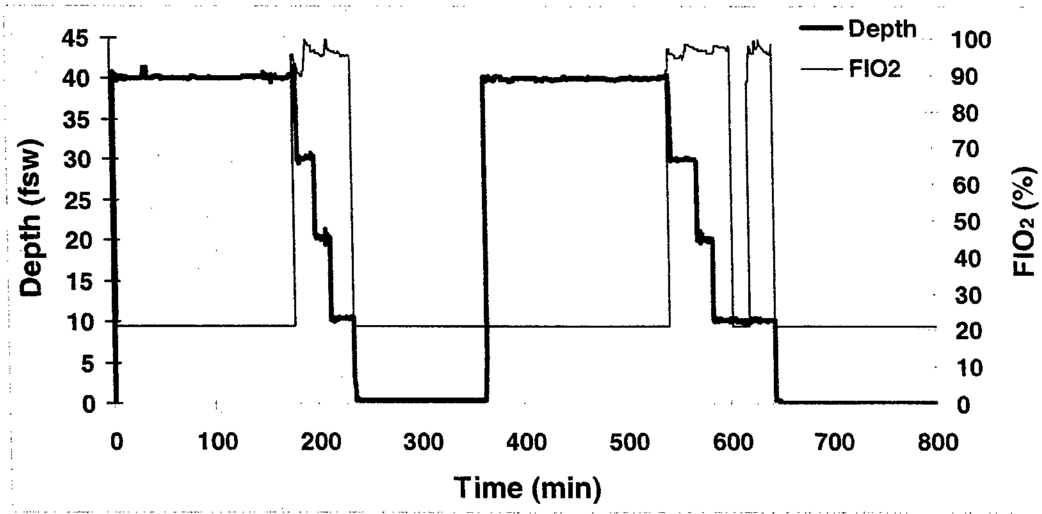

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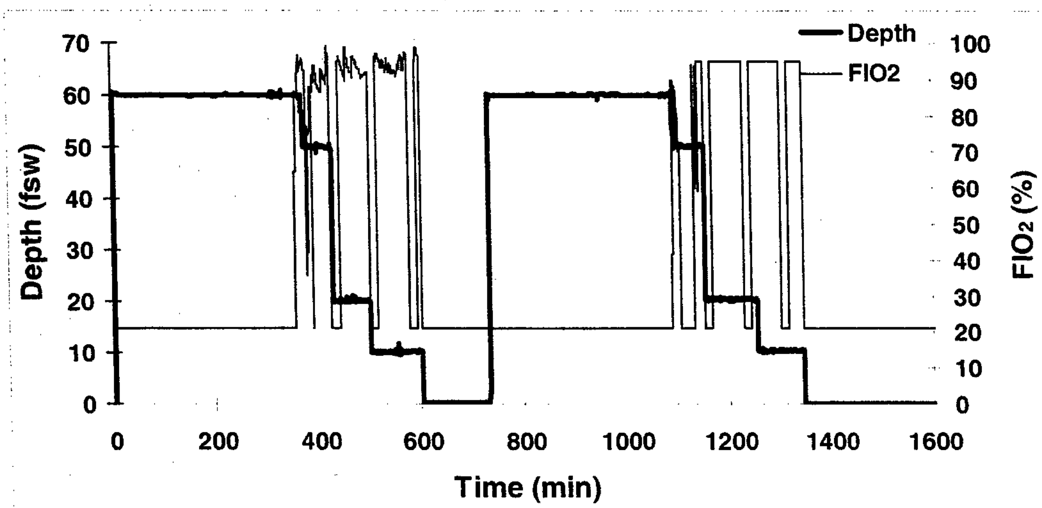

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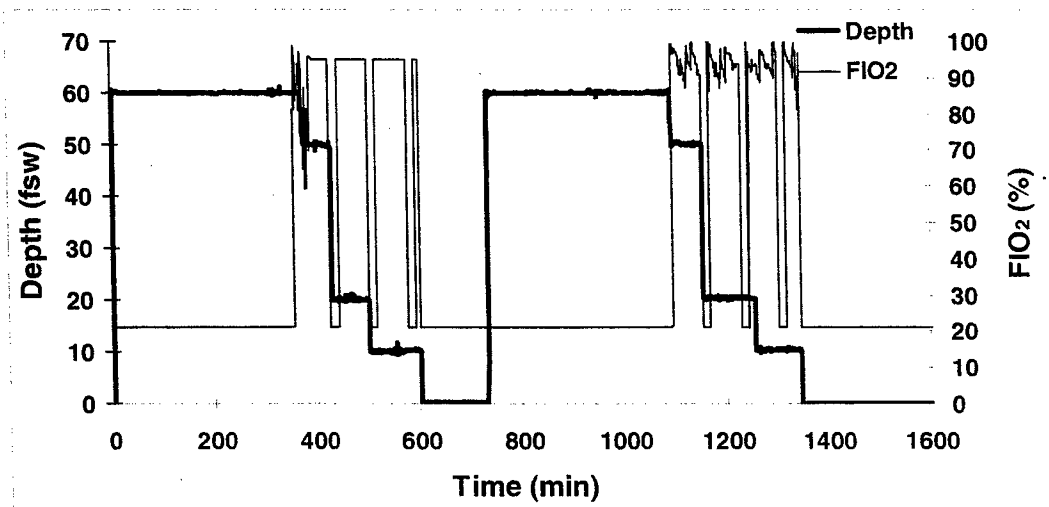

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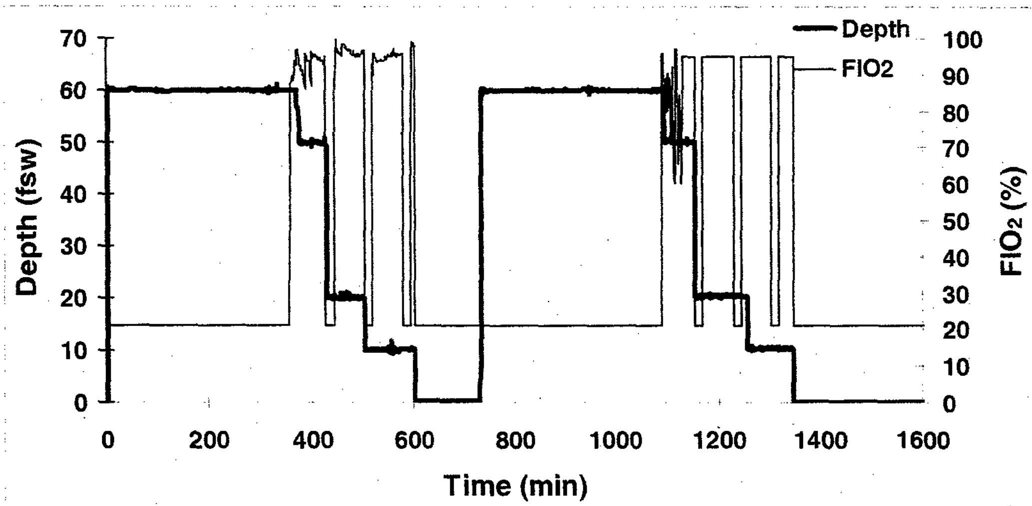

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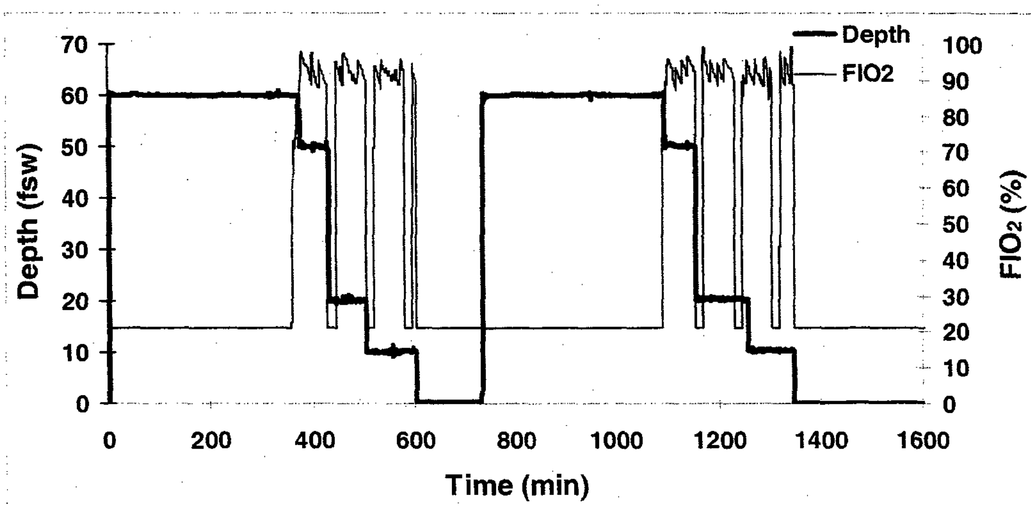

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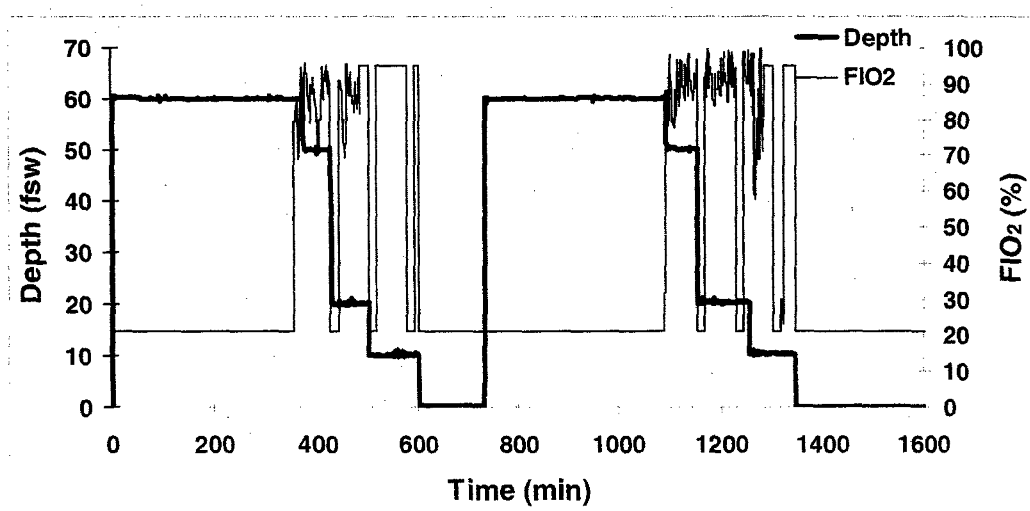

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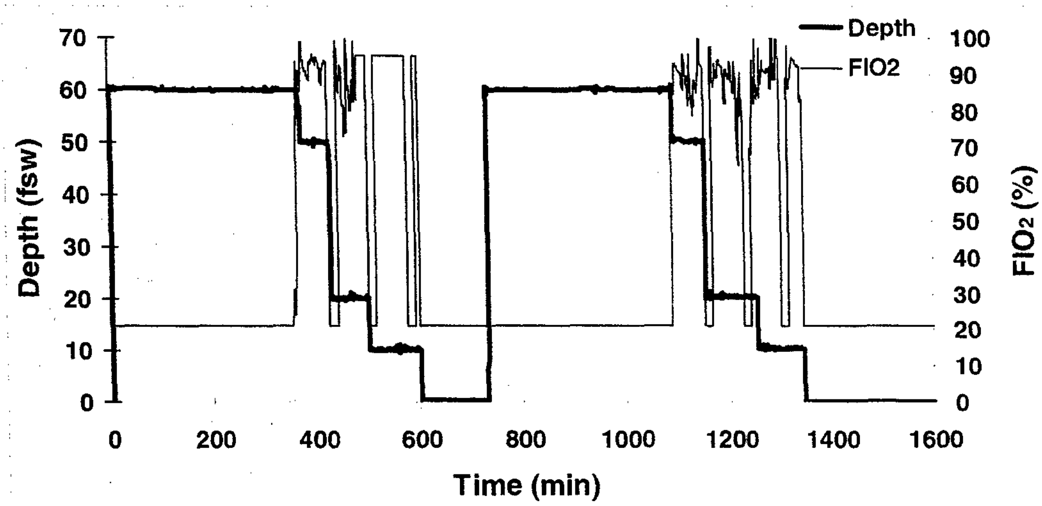

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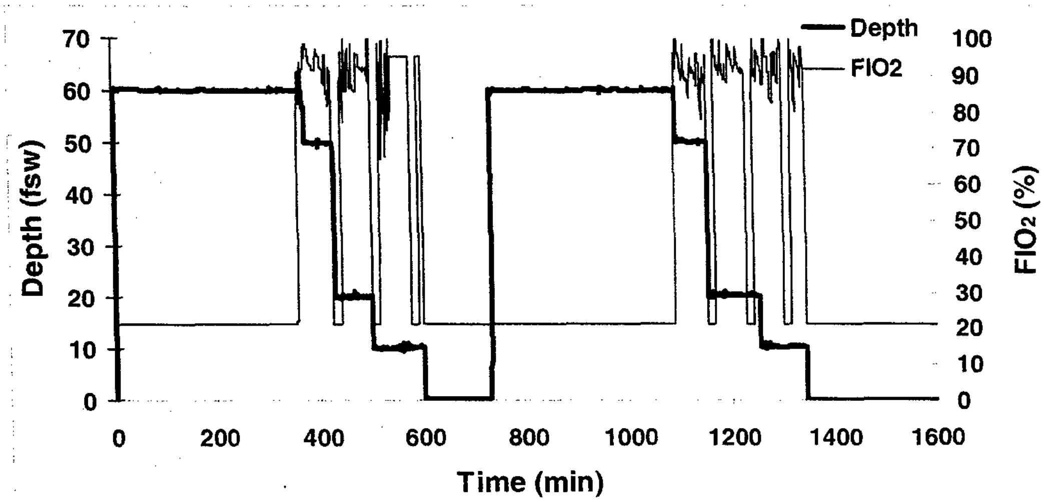

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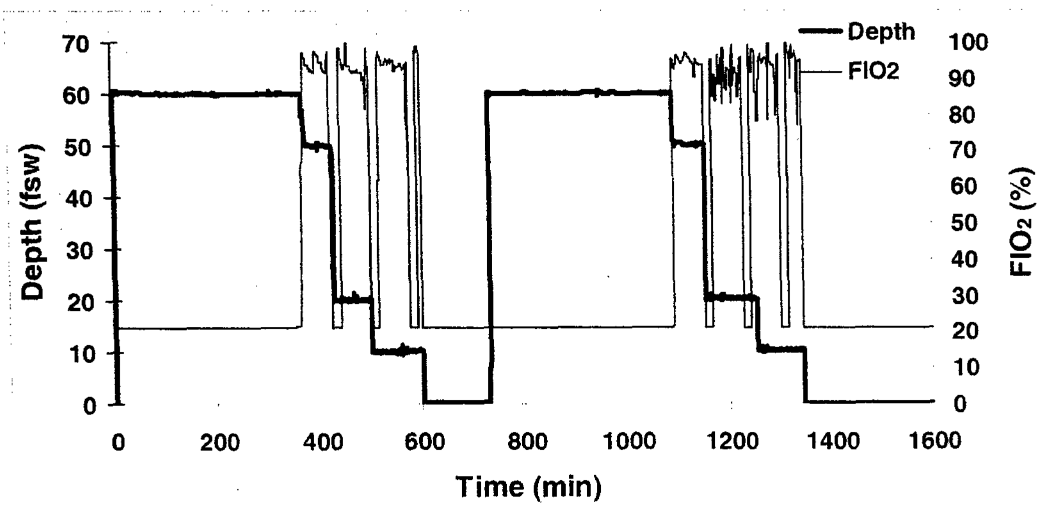

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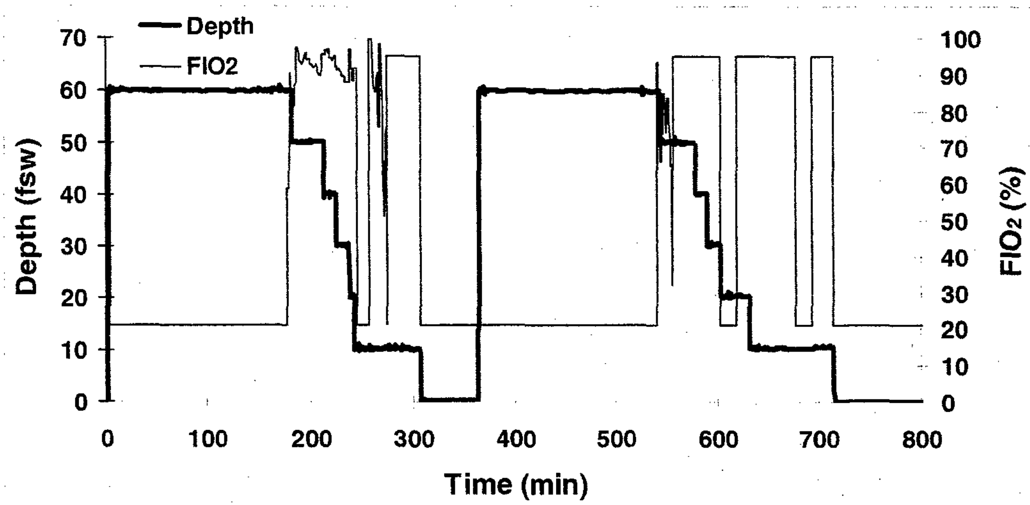

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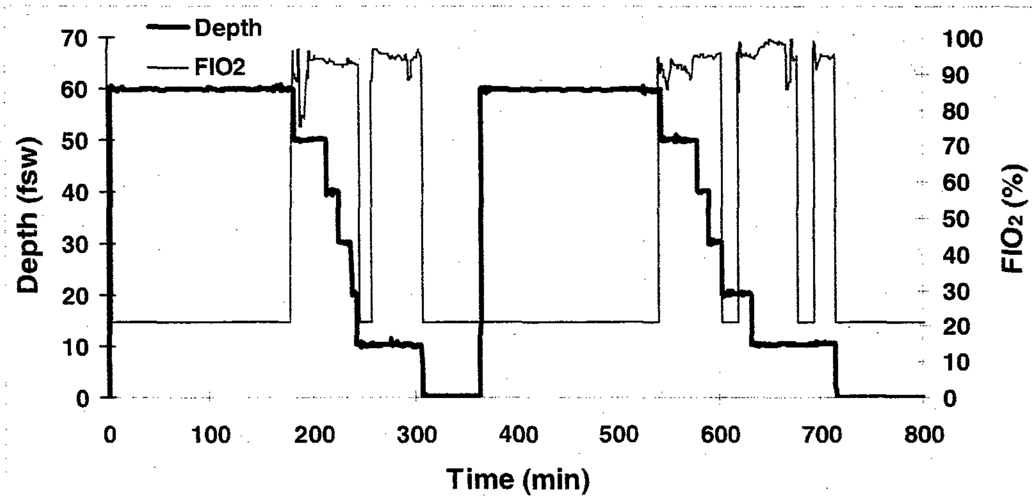

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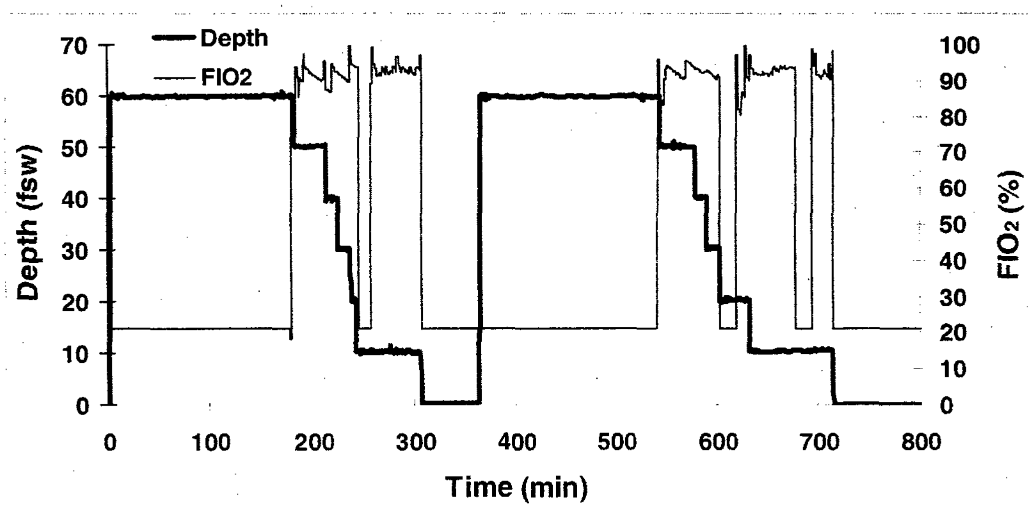

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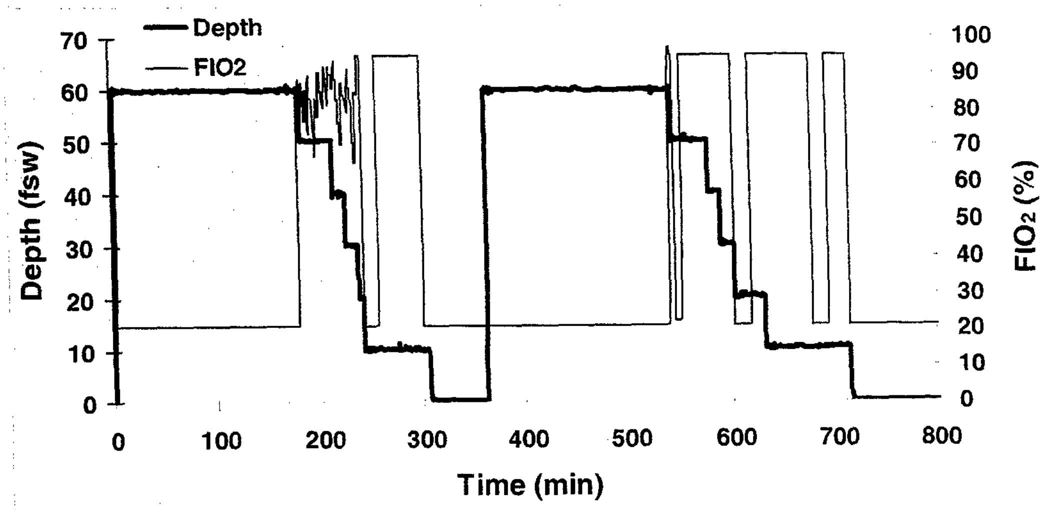

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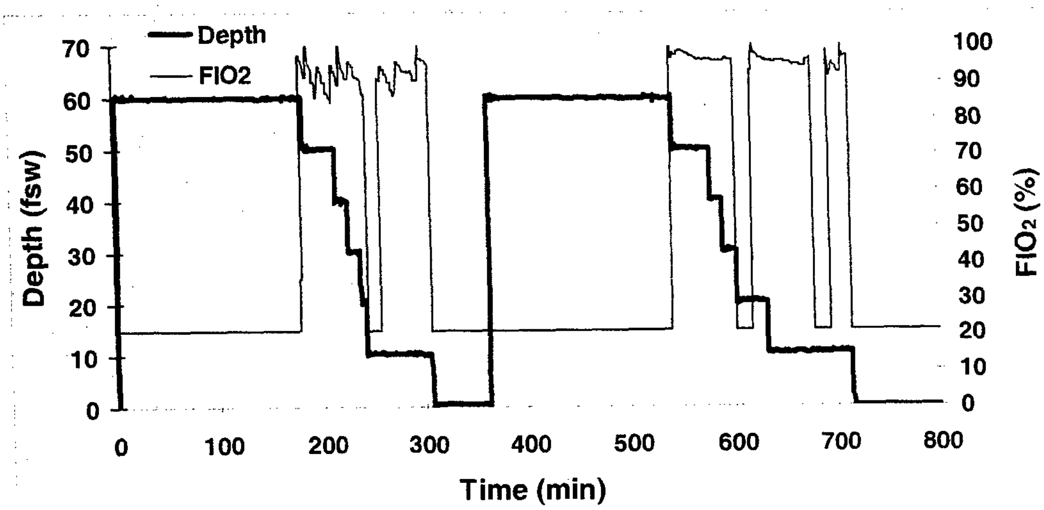

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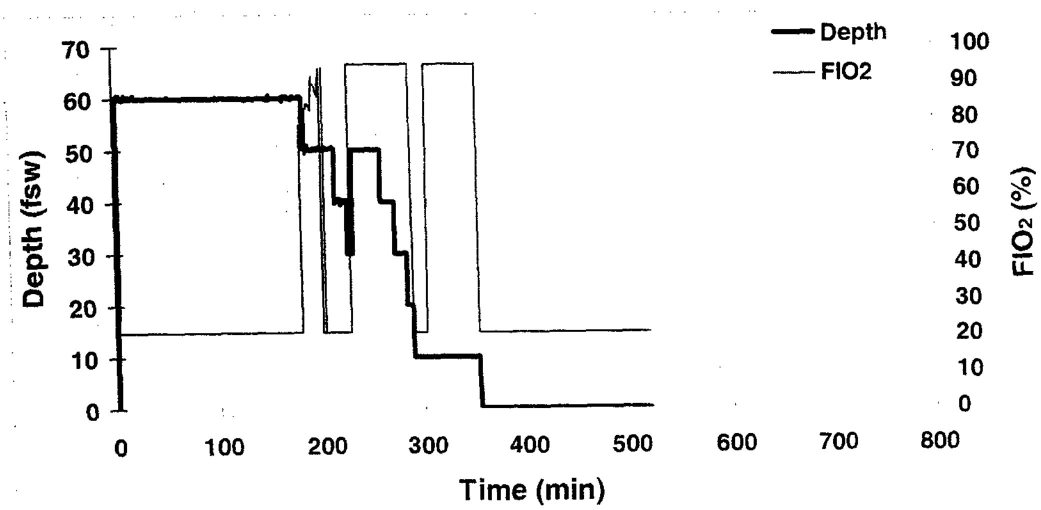

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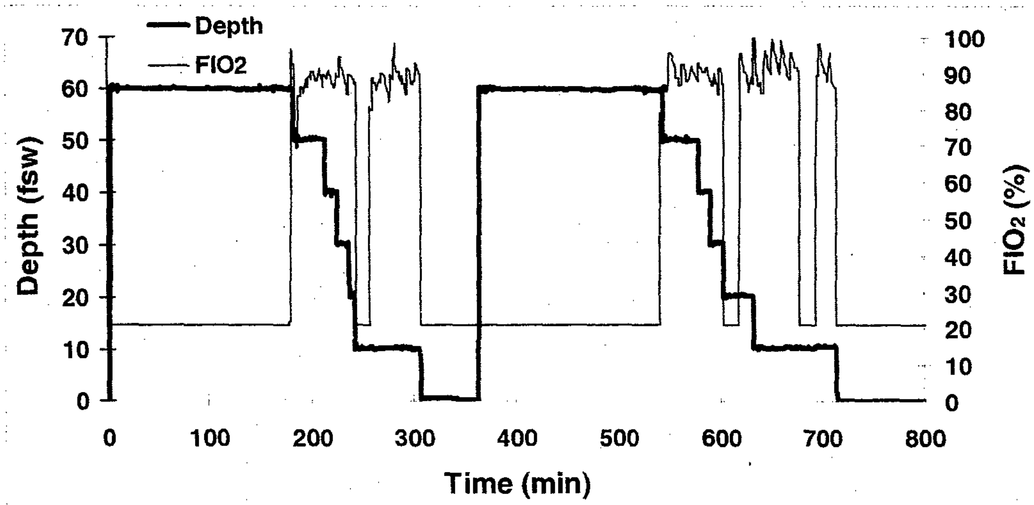

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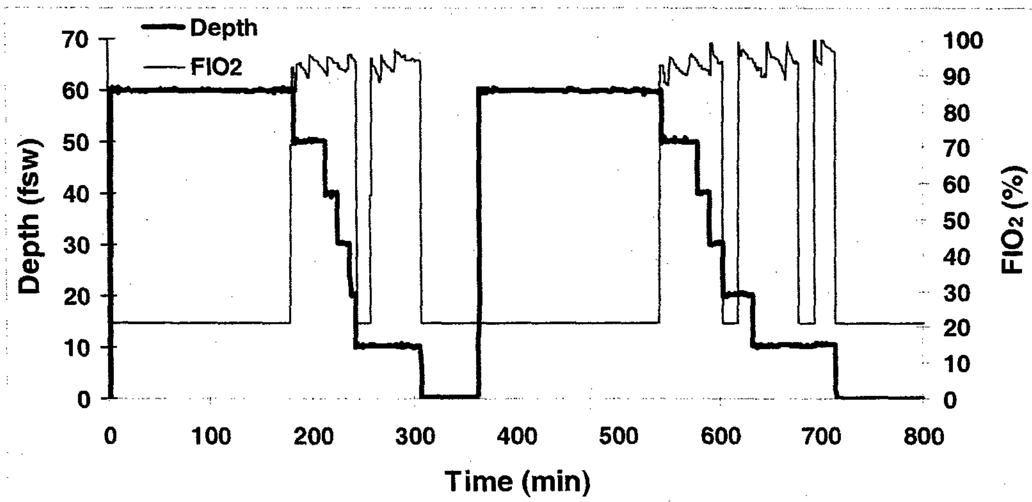

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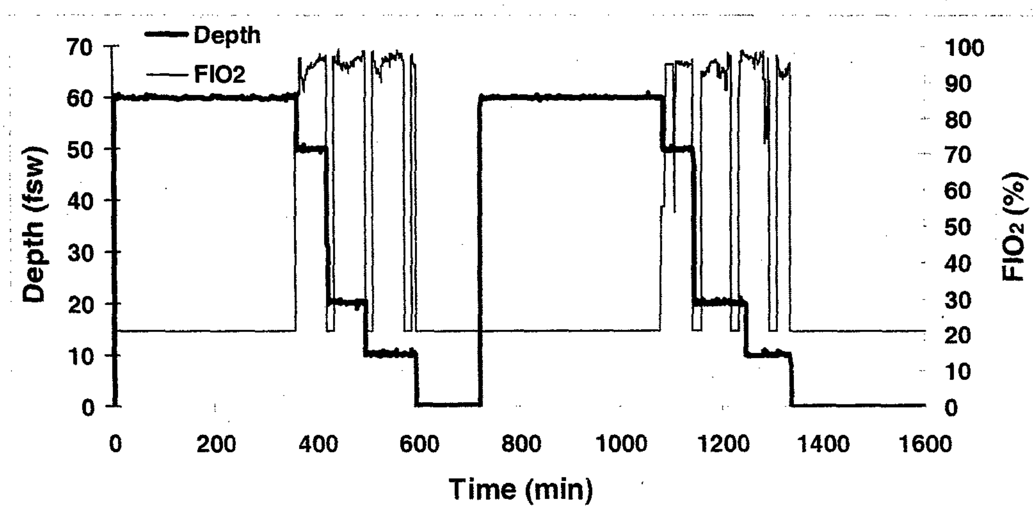

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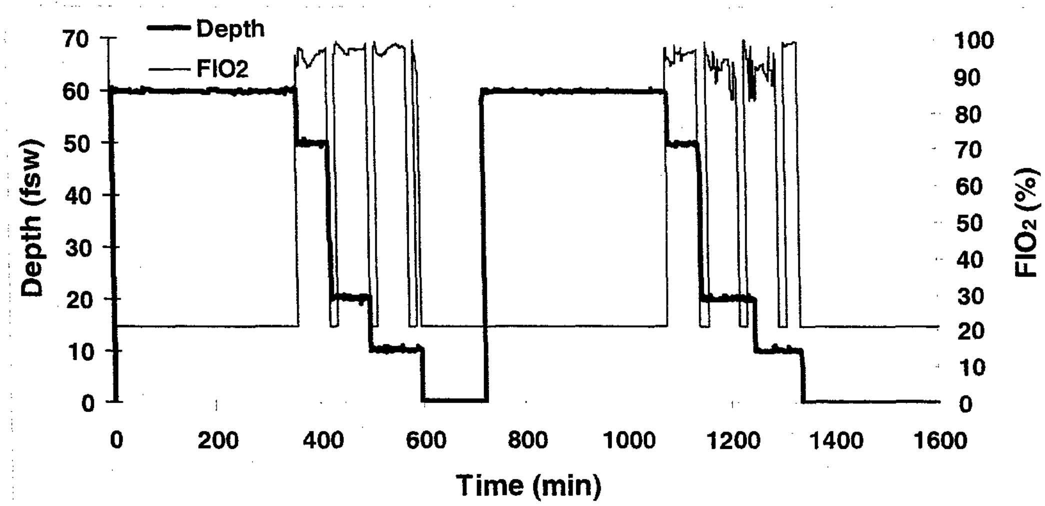

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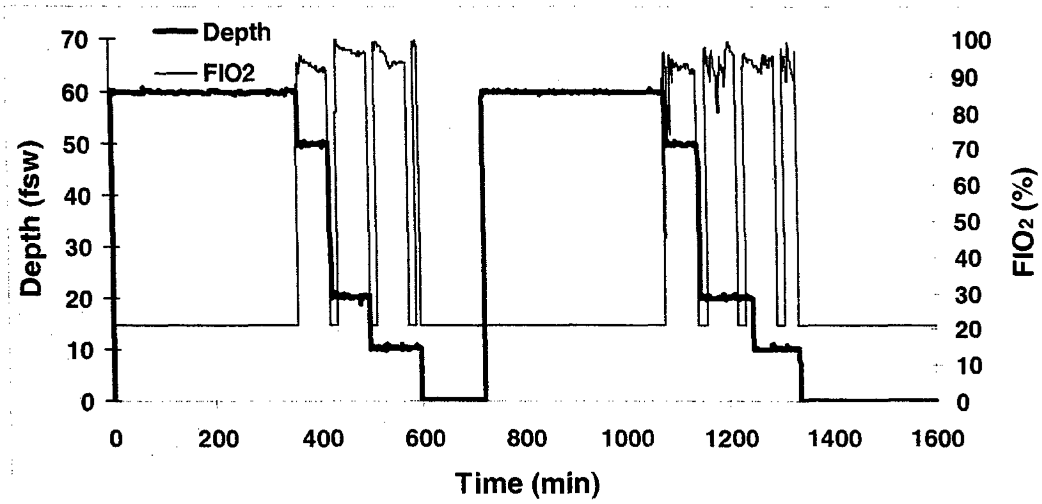

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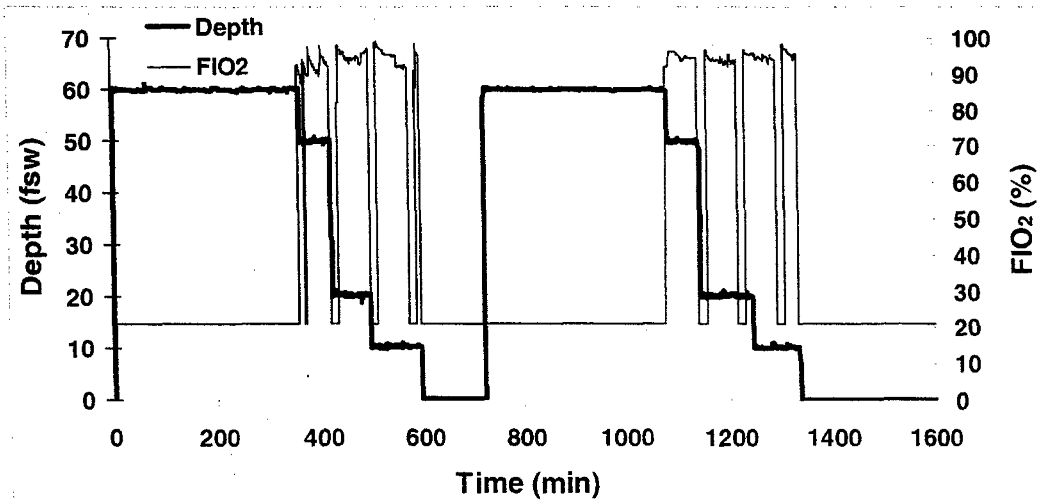

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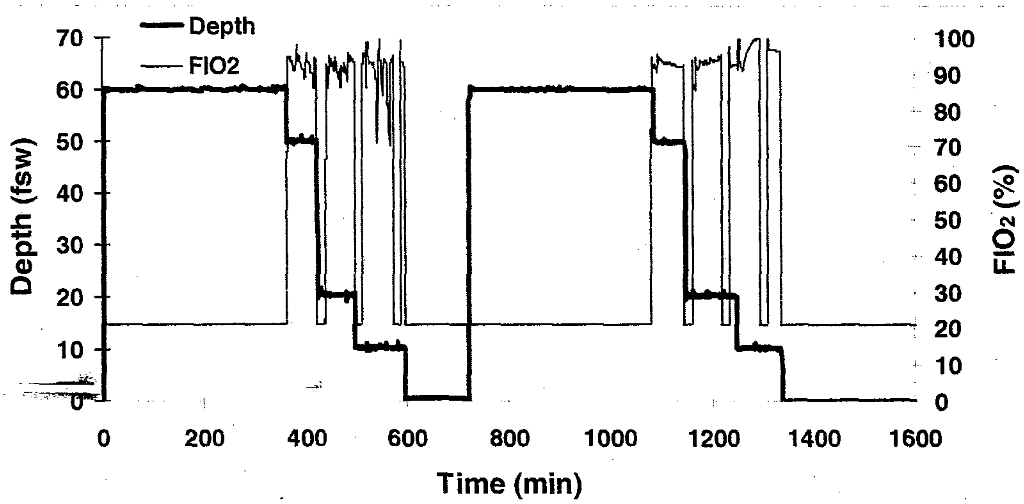

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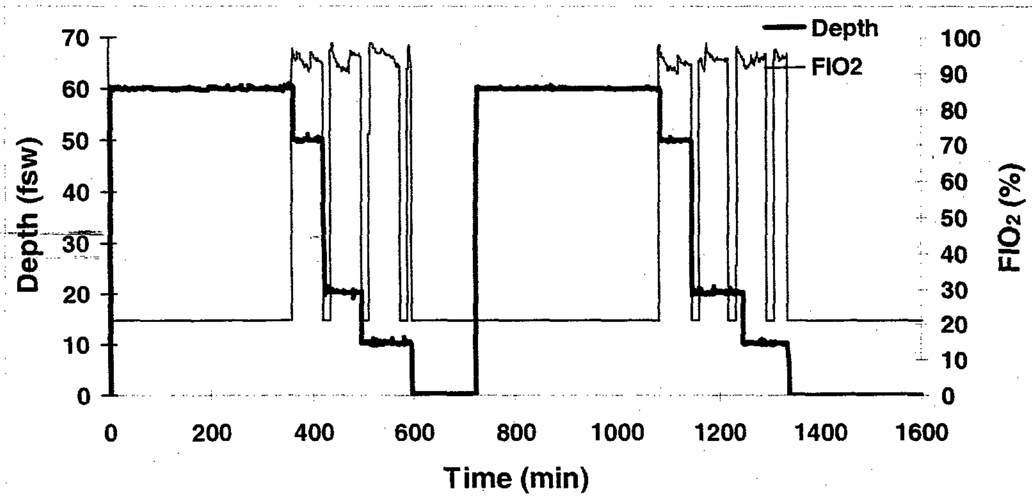

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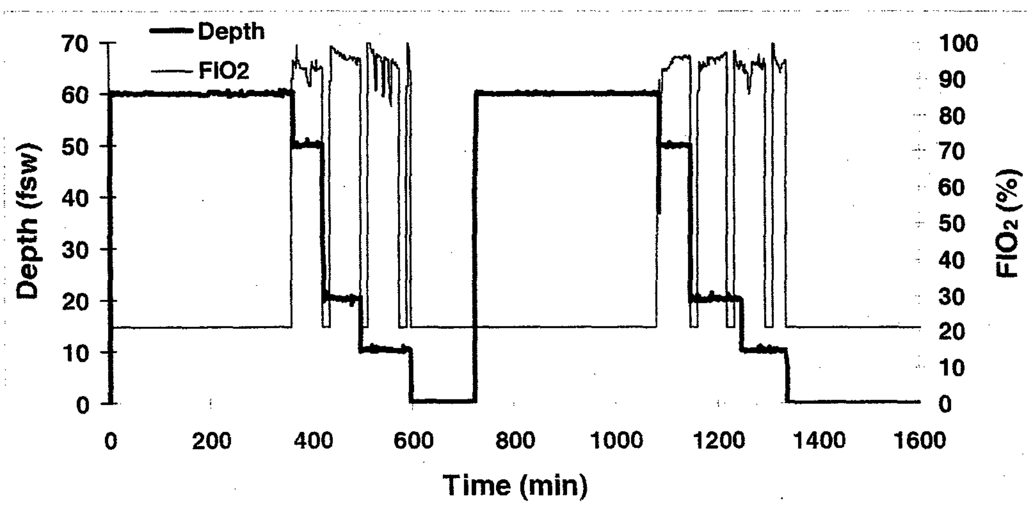

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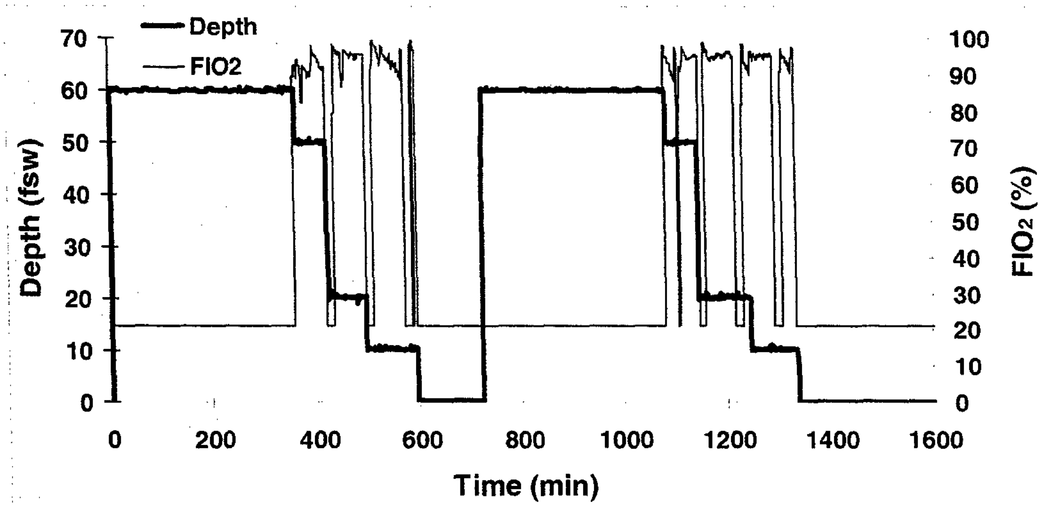

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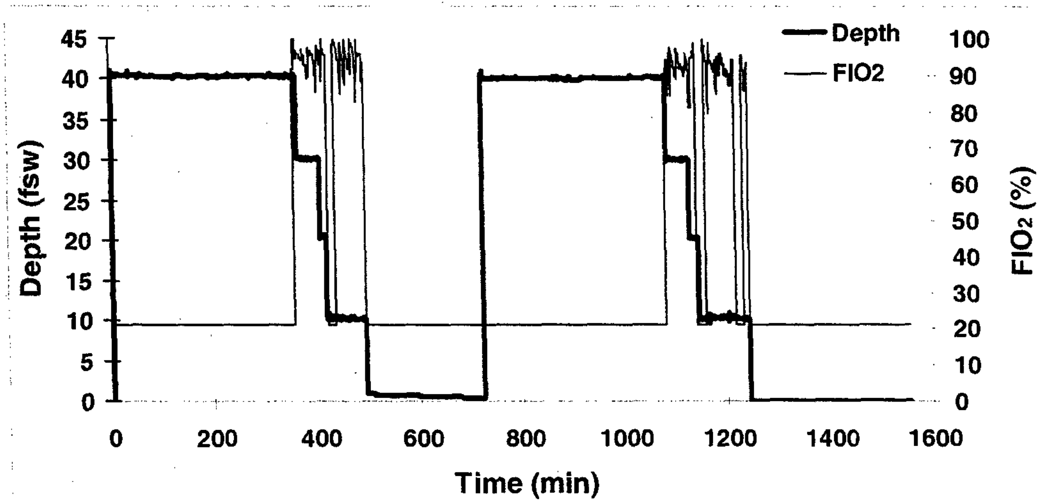

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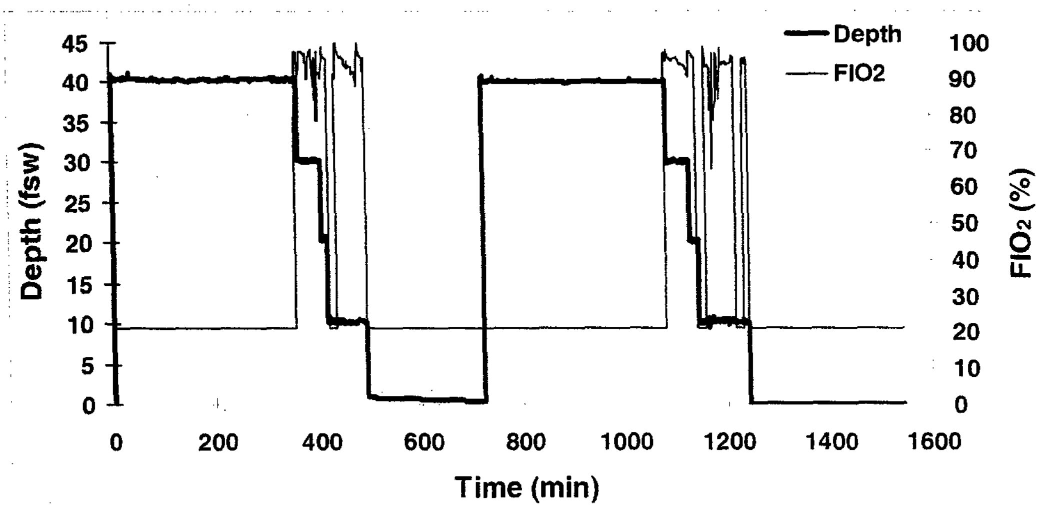

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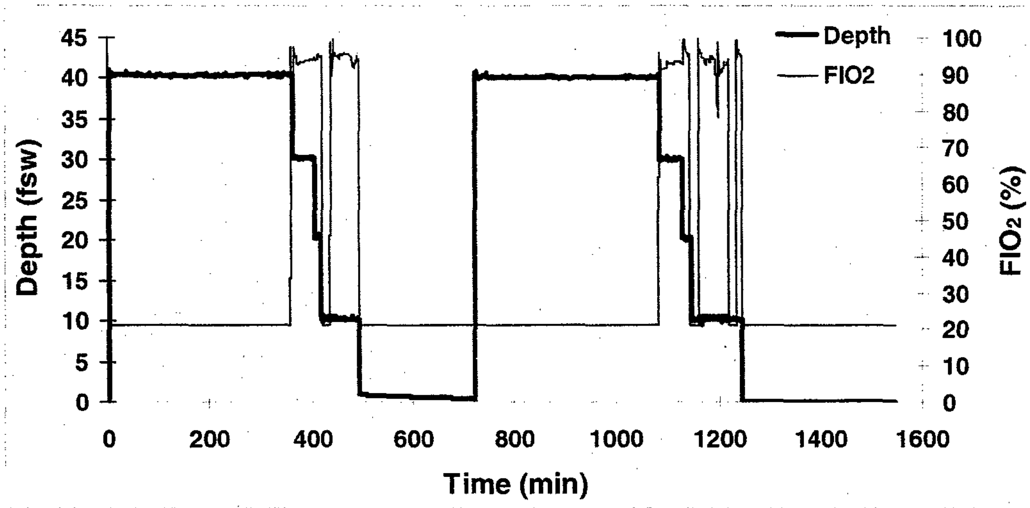
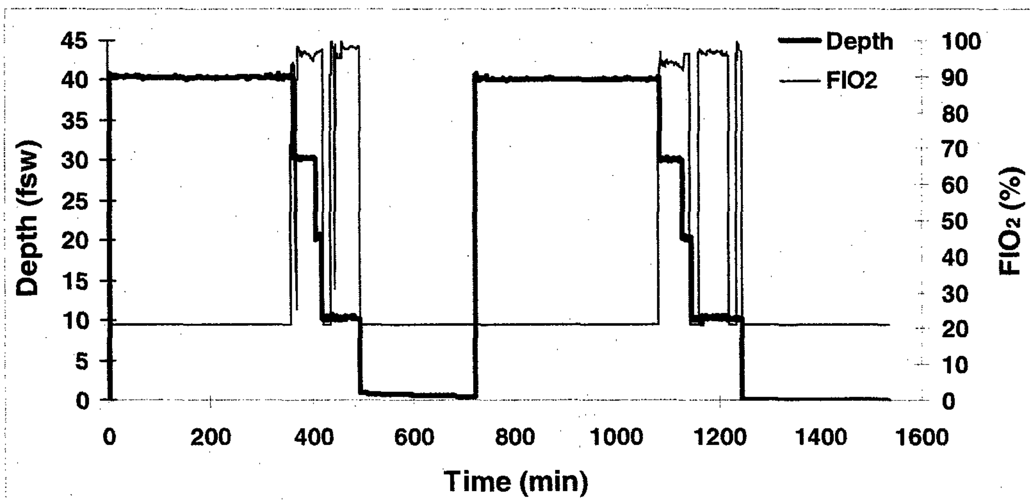


Profile 020813D03; DiverID 10



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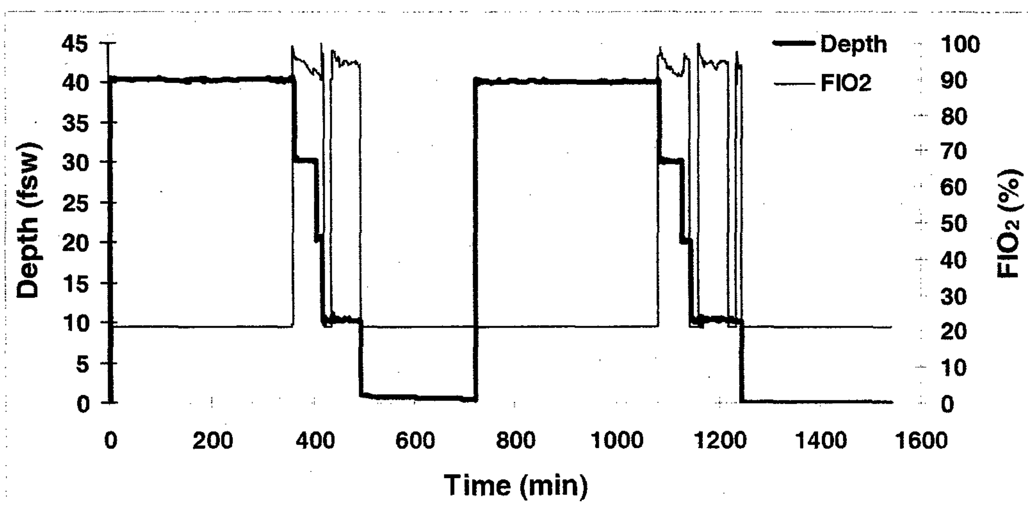

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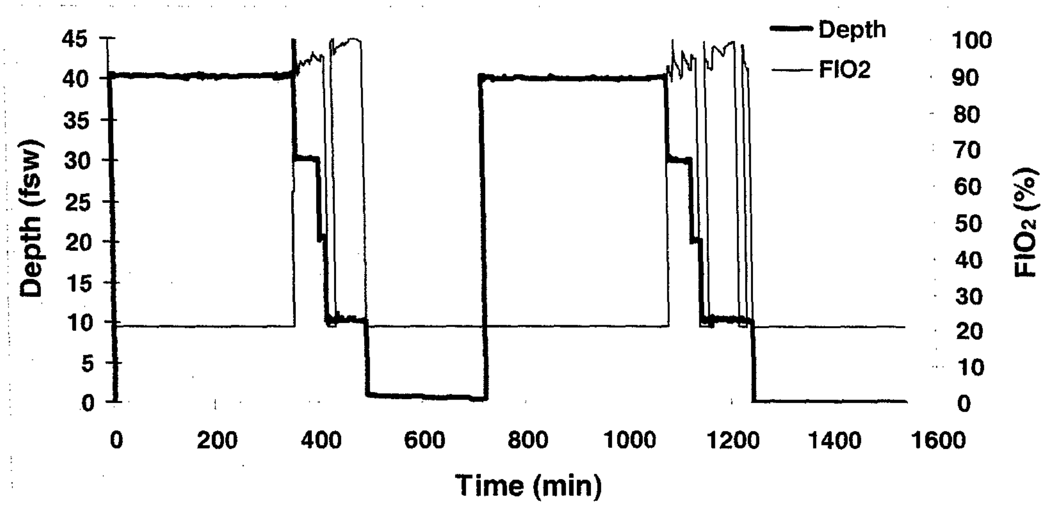

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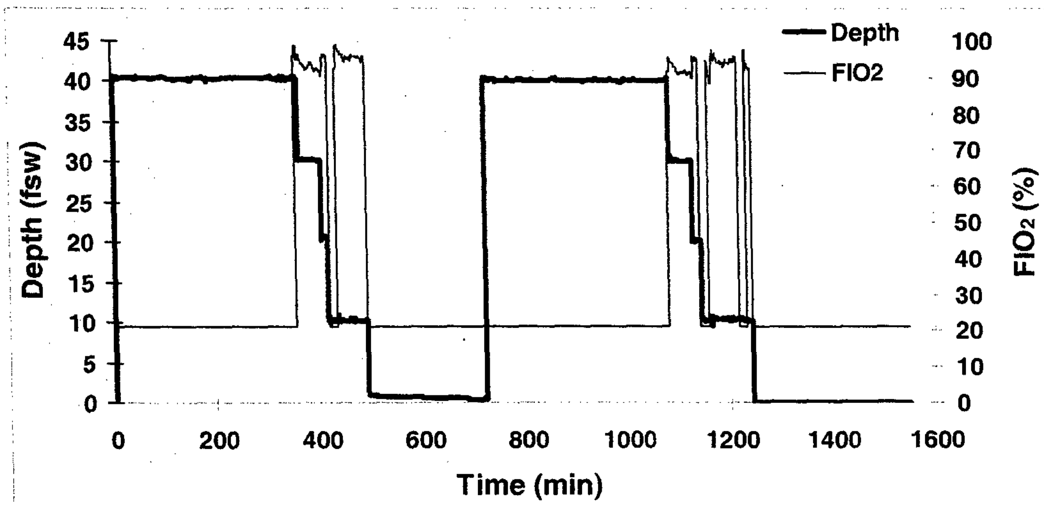

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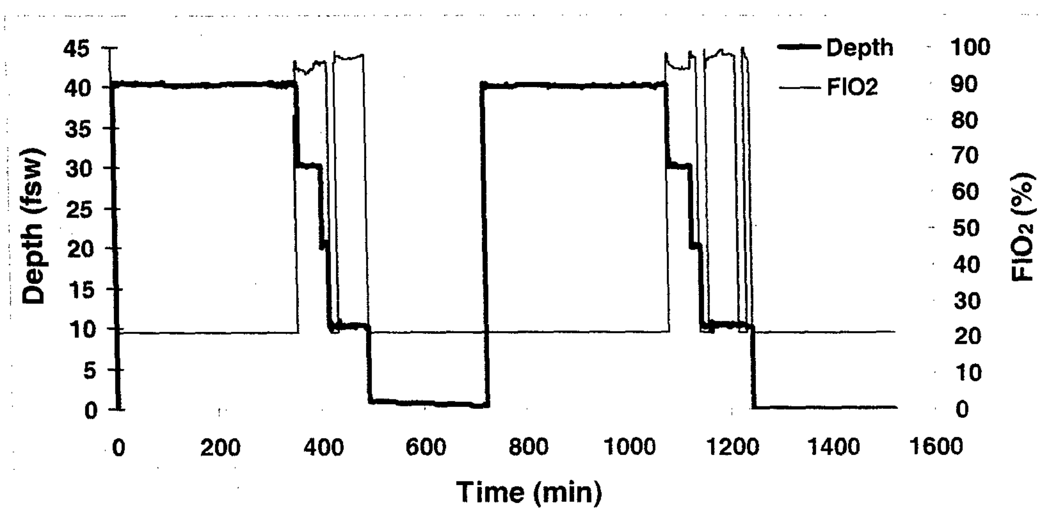

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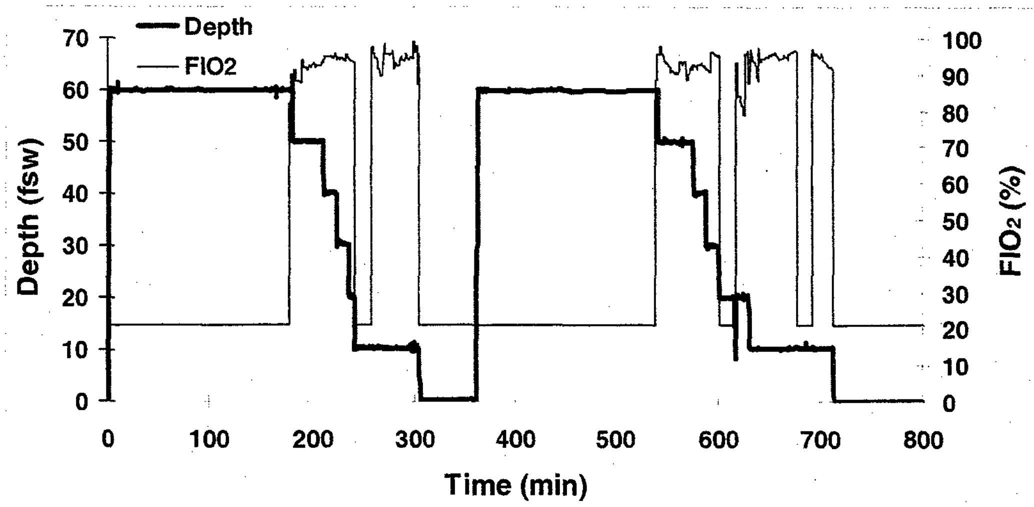

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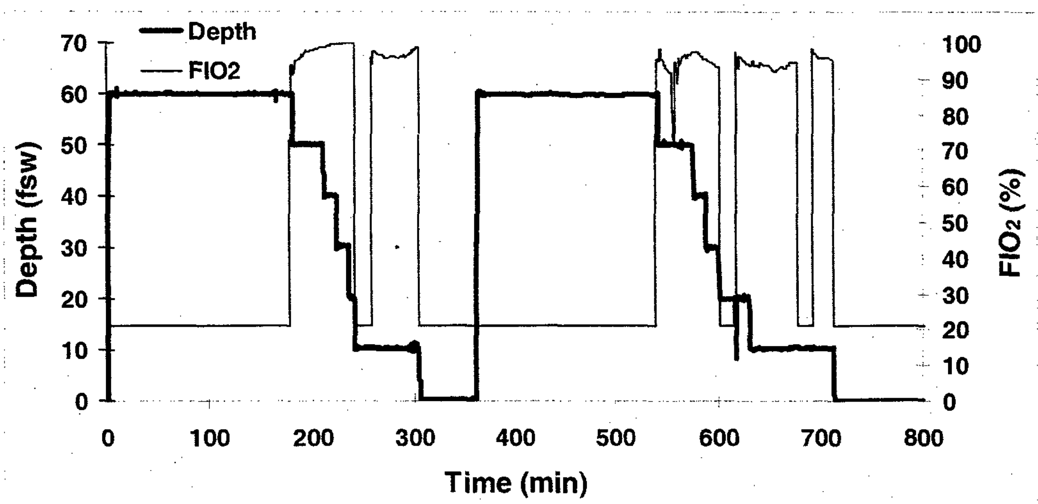

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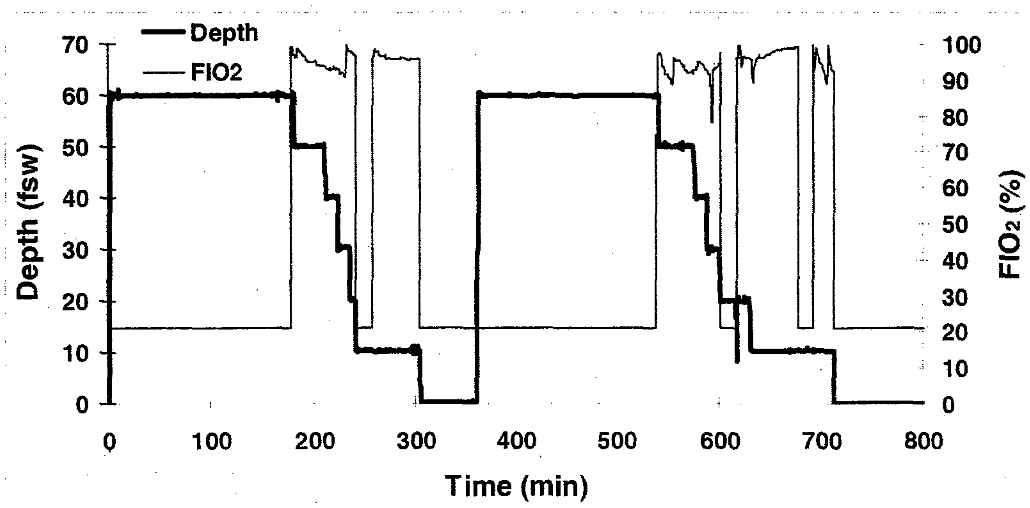

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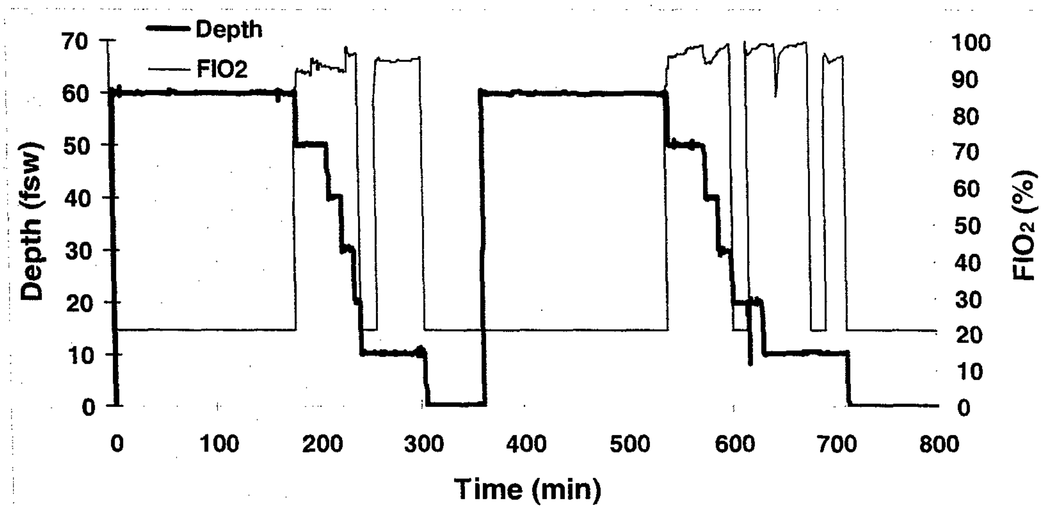

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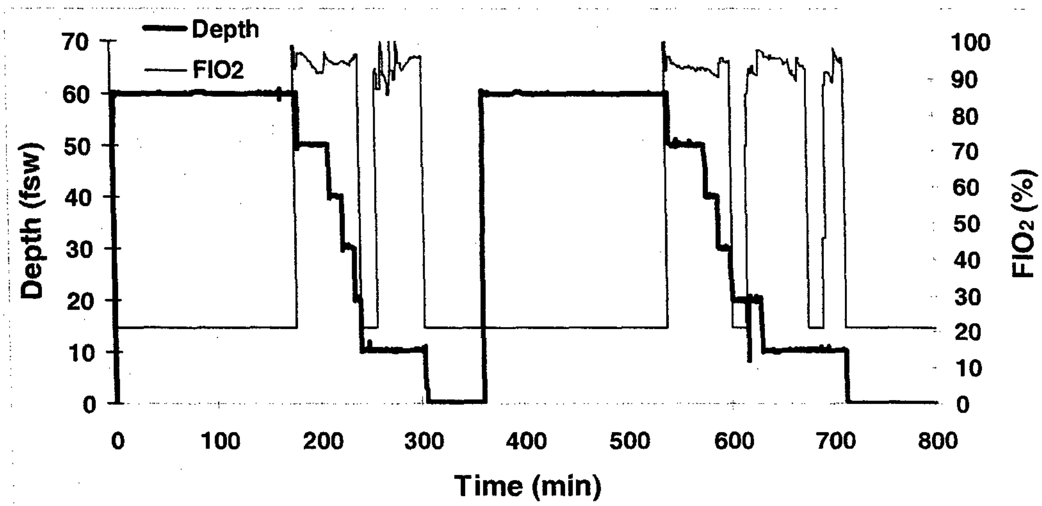

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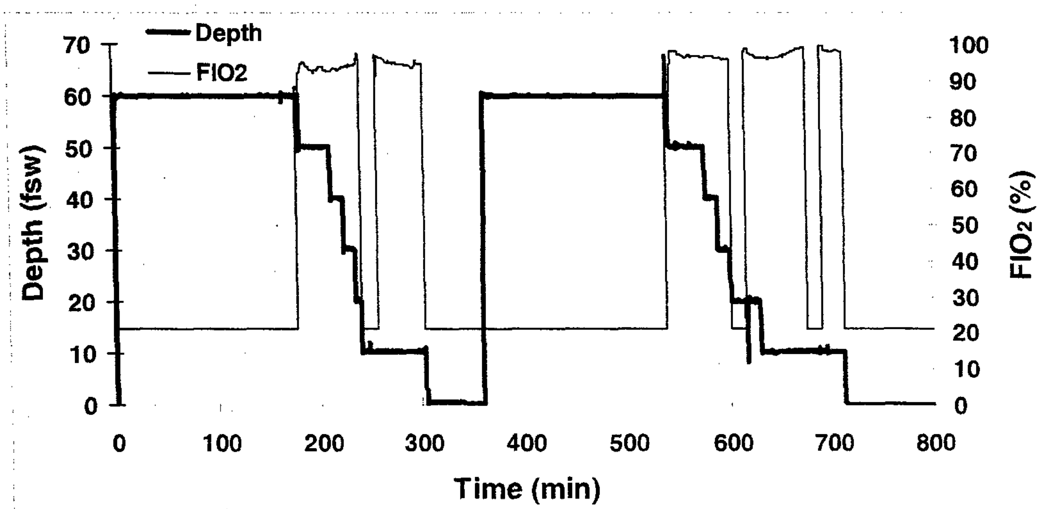

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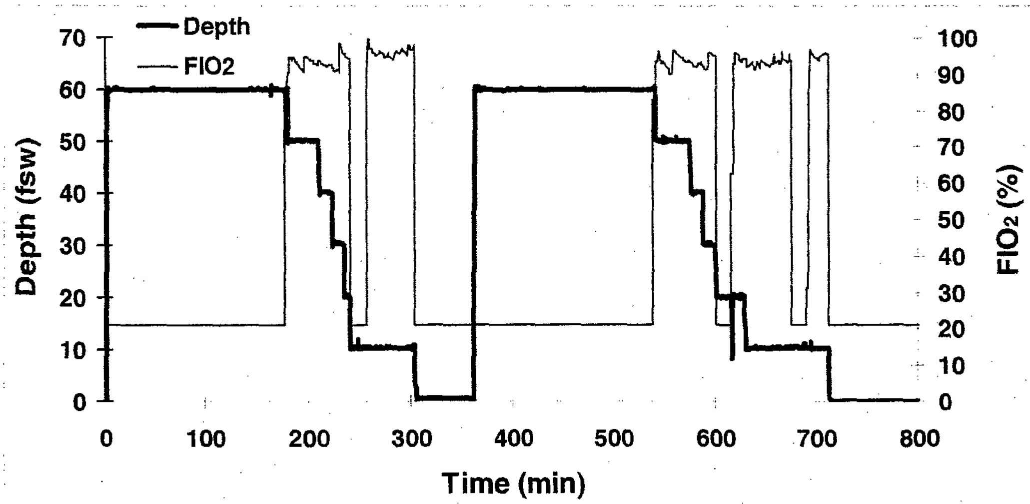

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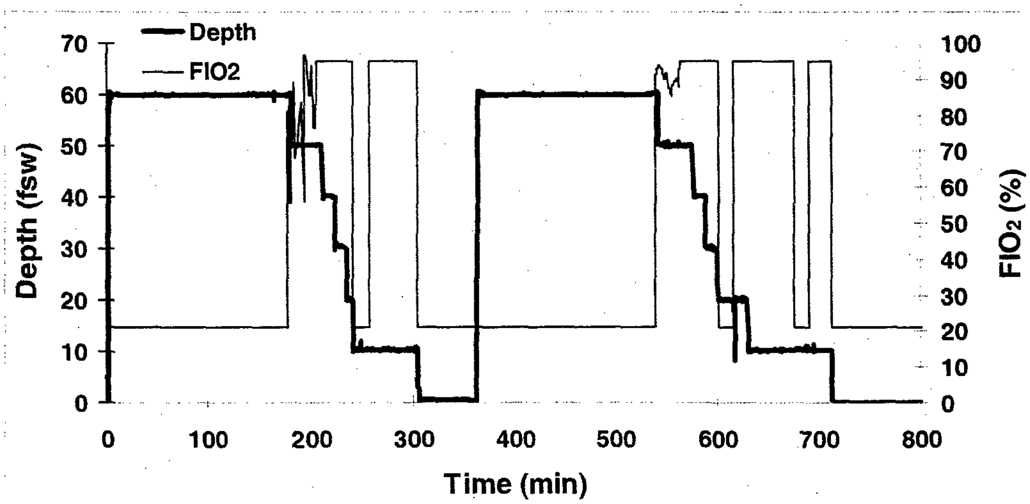

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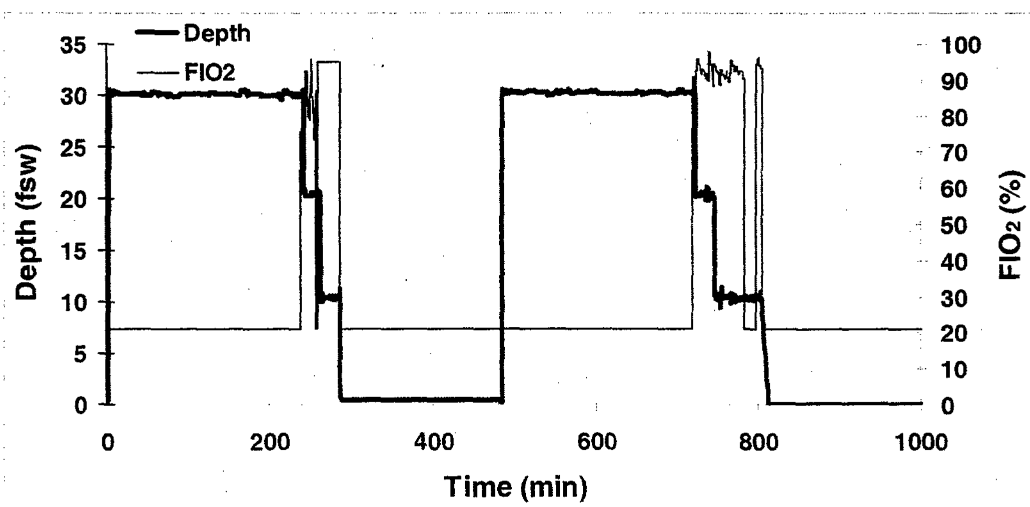

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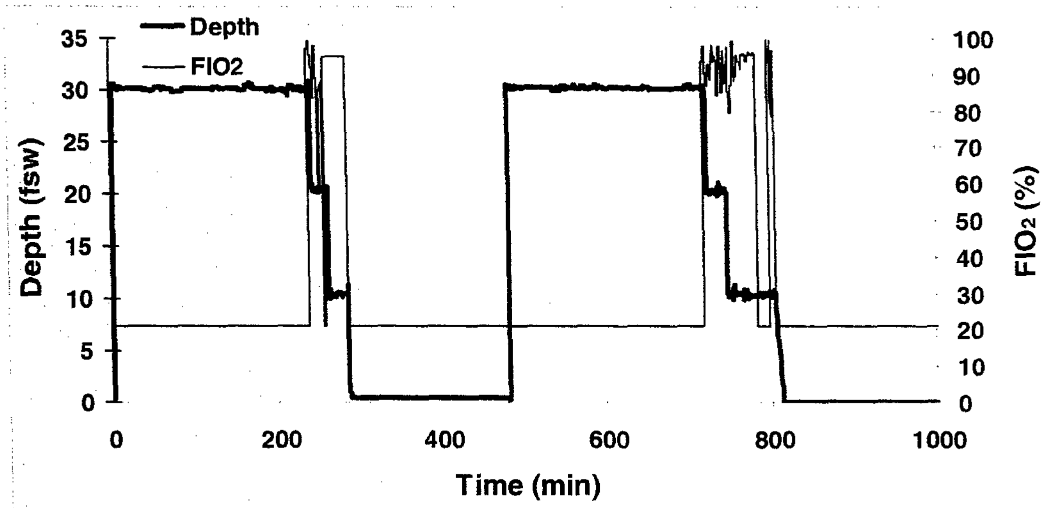
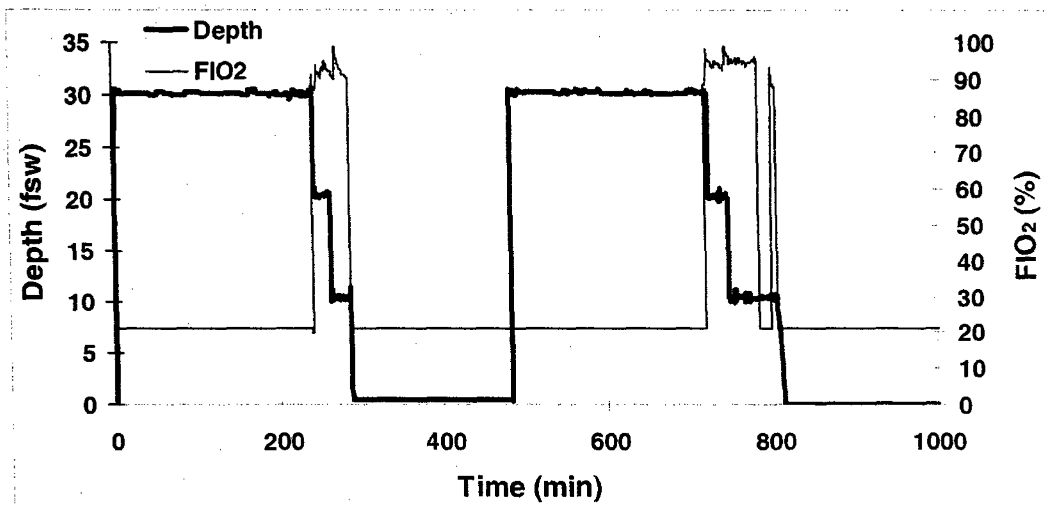


Profile 020820D02; DiverID 57



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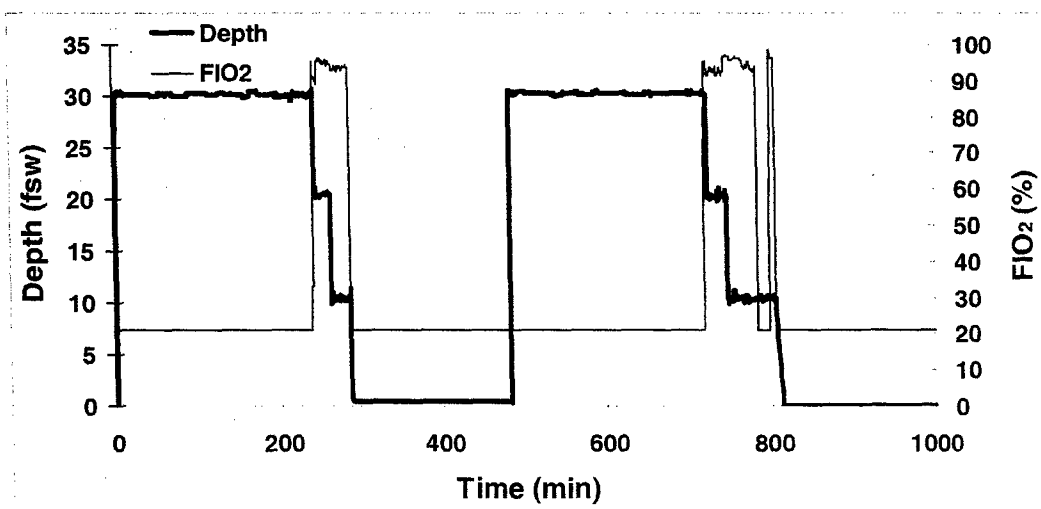

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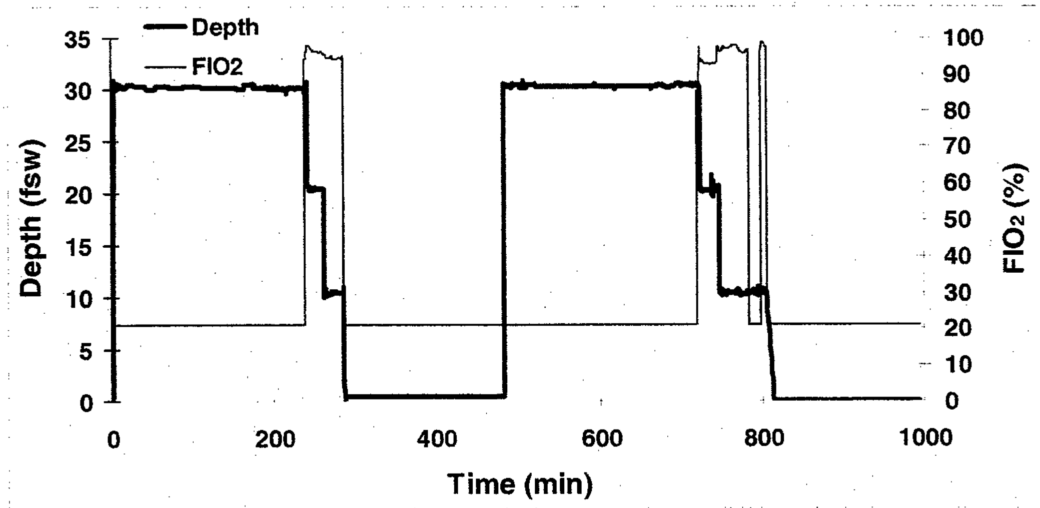

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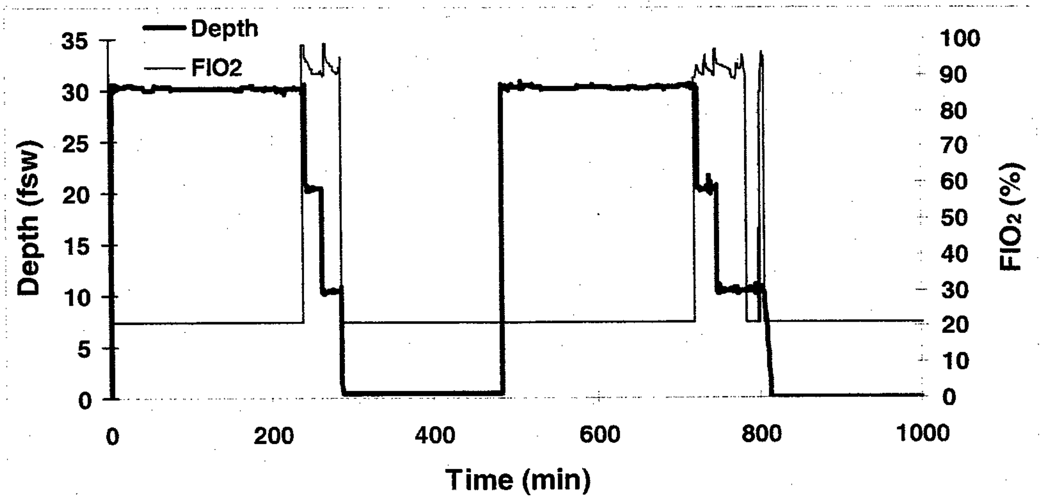

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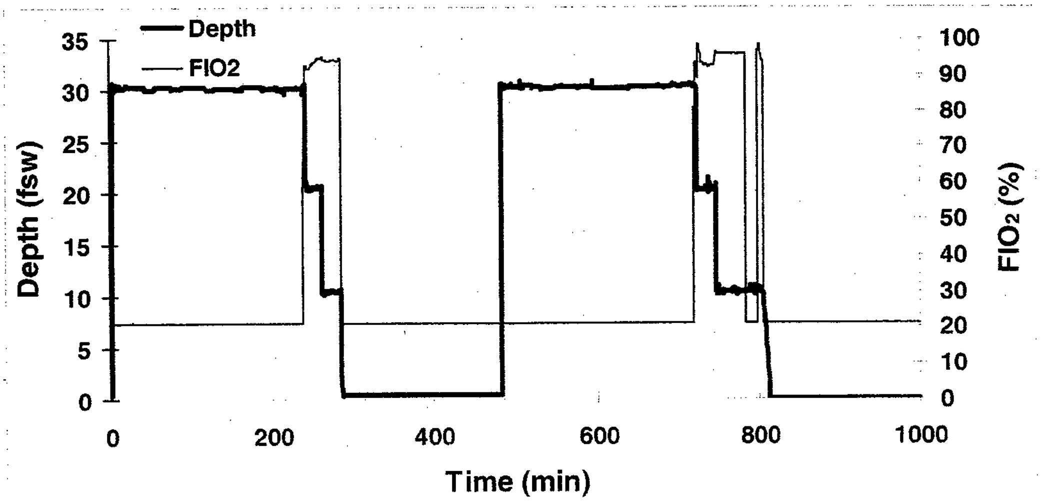

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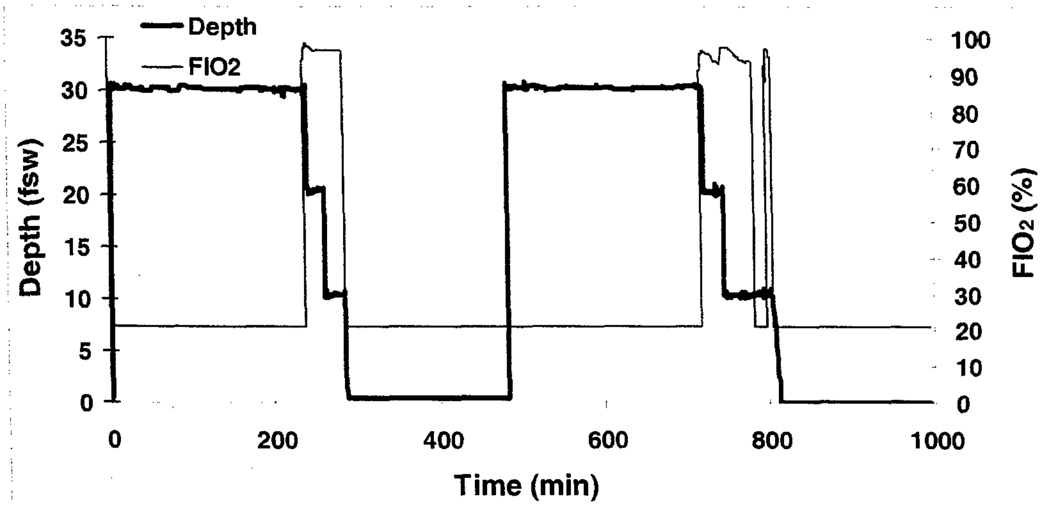

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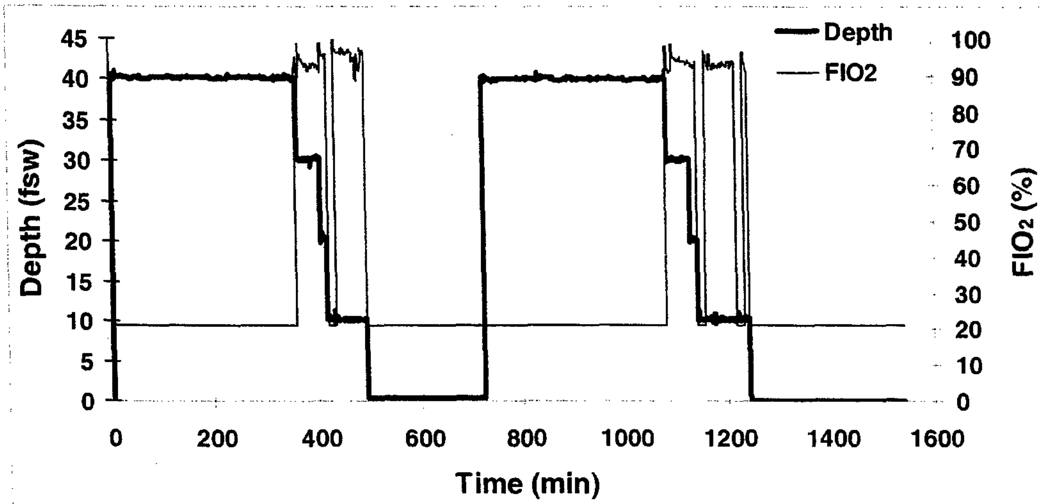

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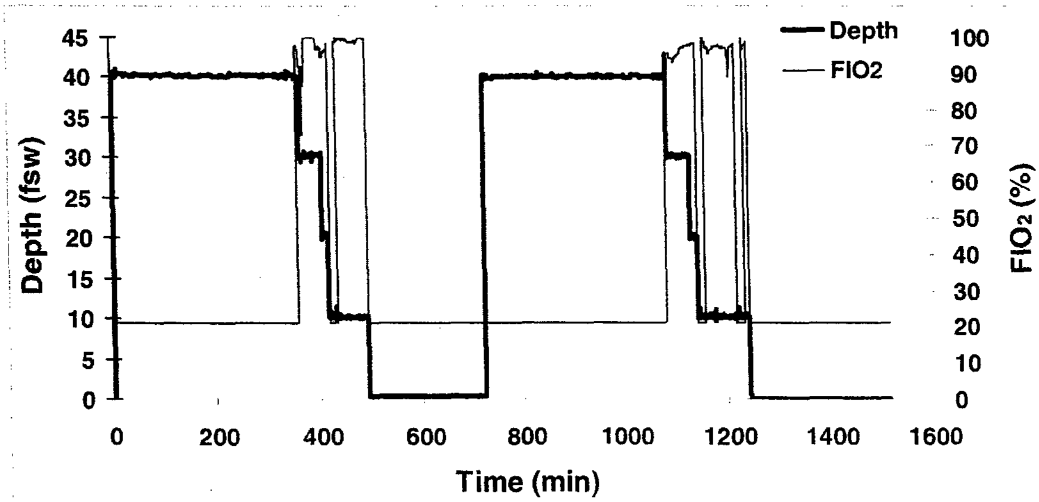

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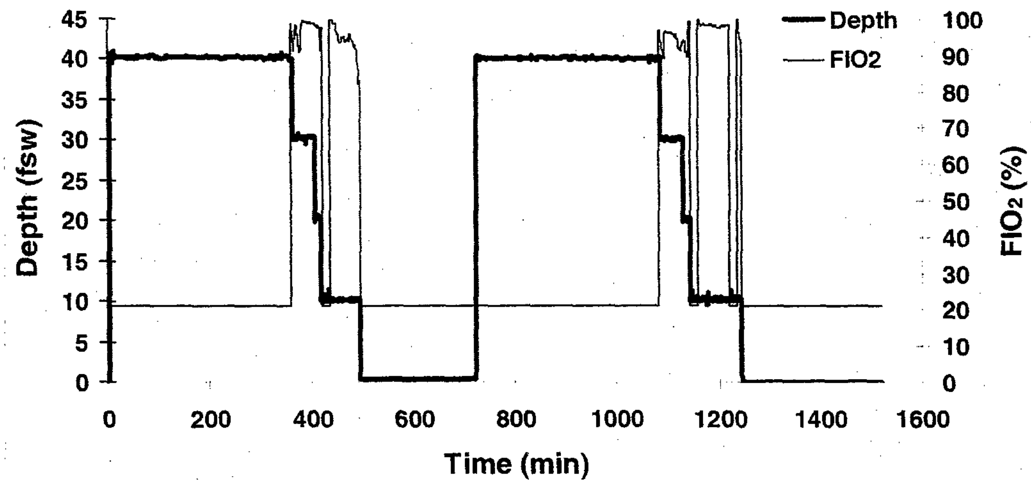
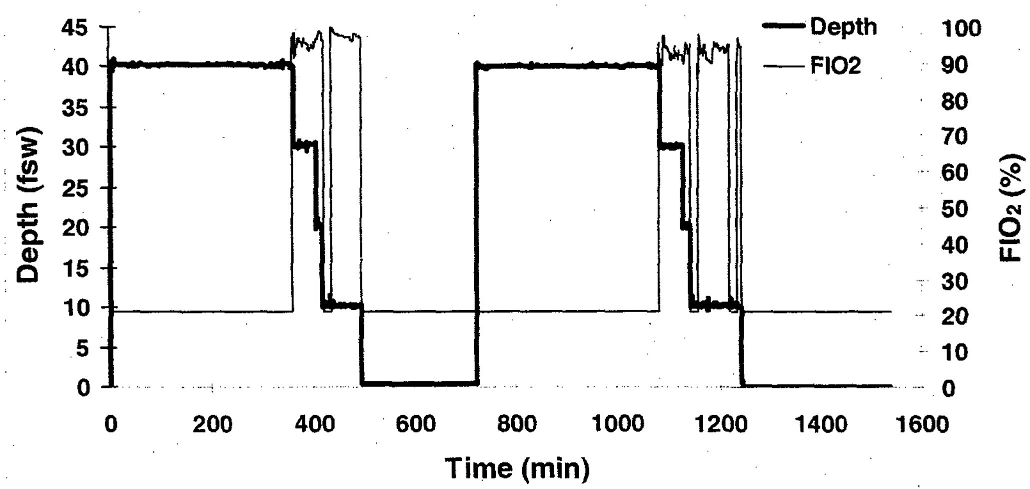


Profile 020822D03; DiverID 28



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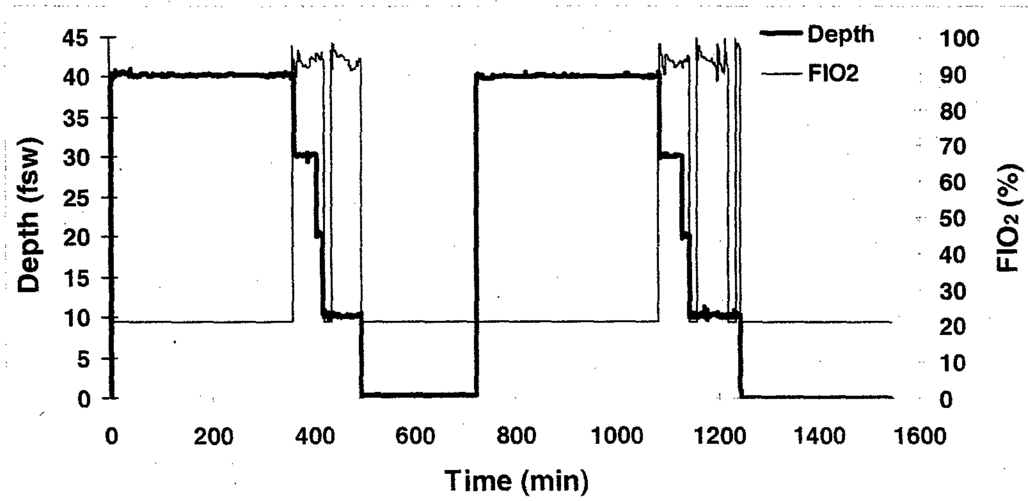

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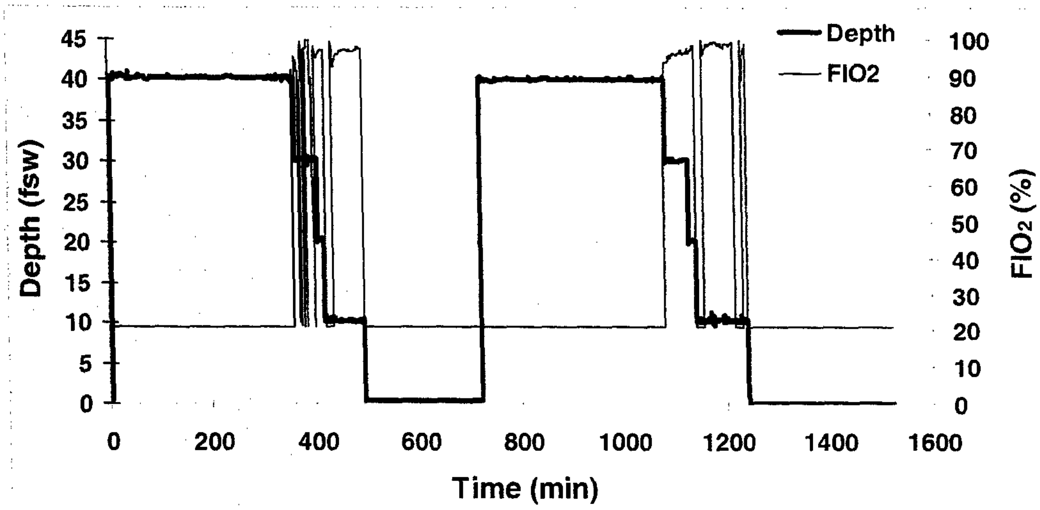

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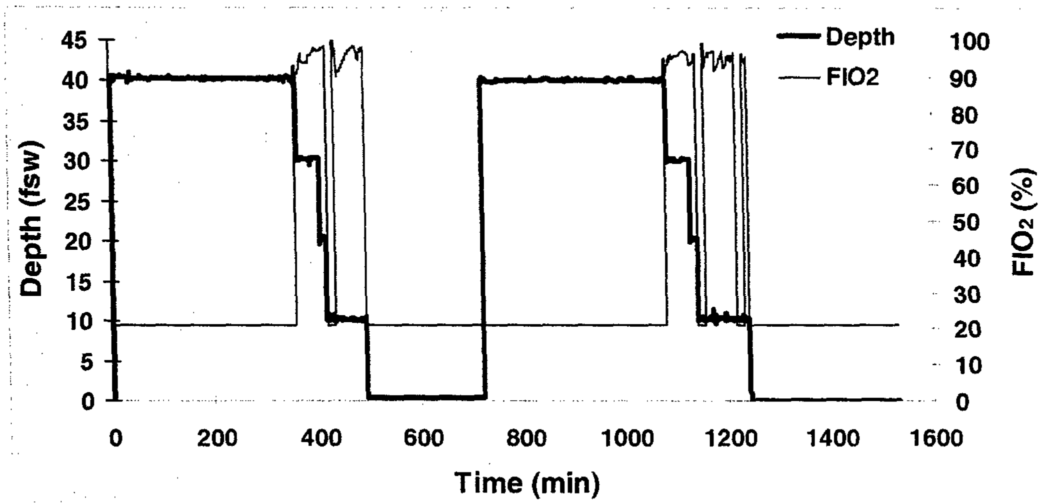

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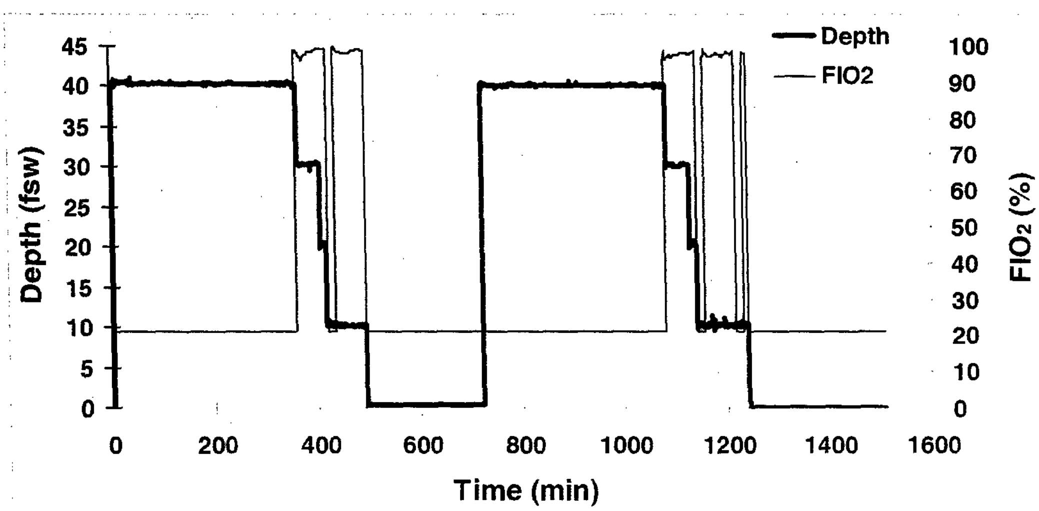

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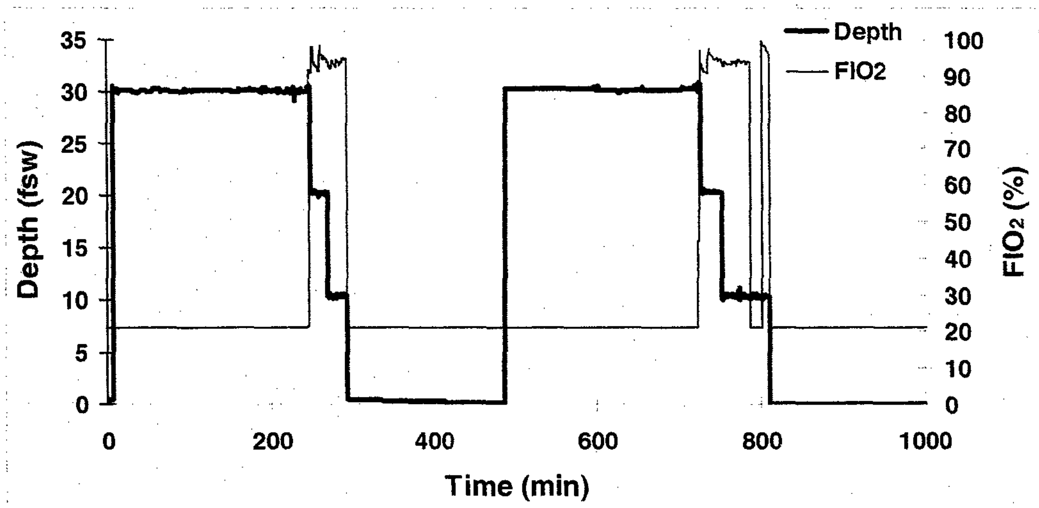

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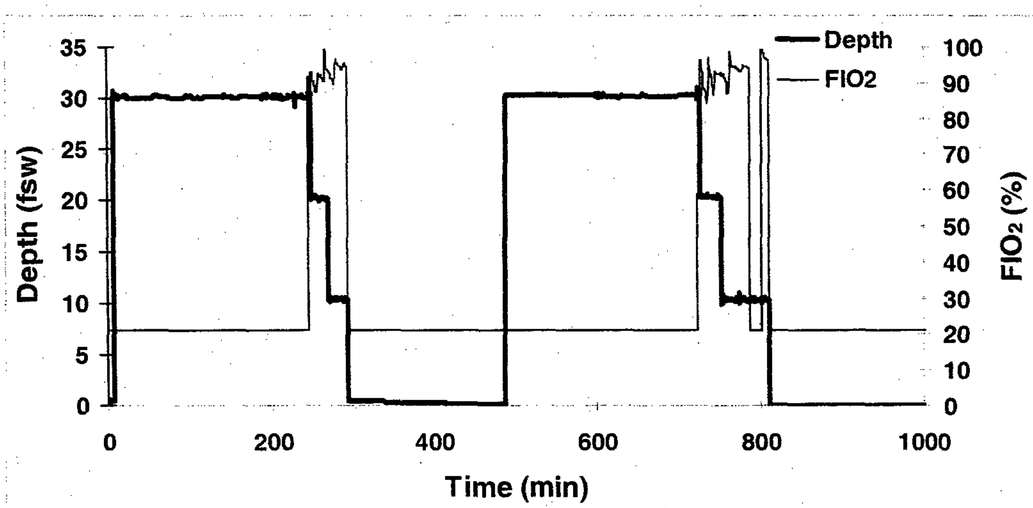

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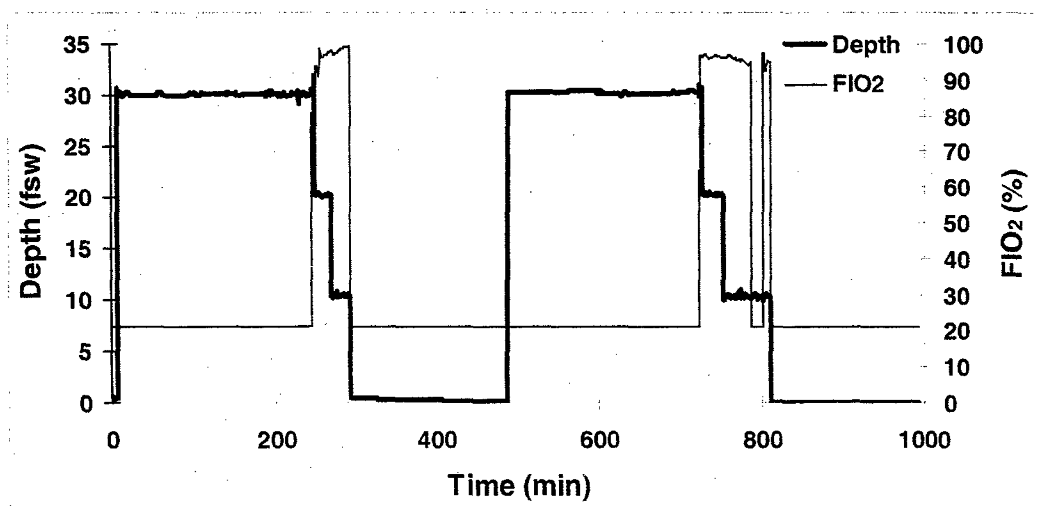

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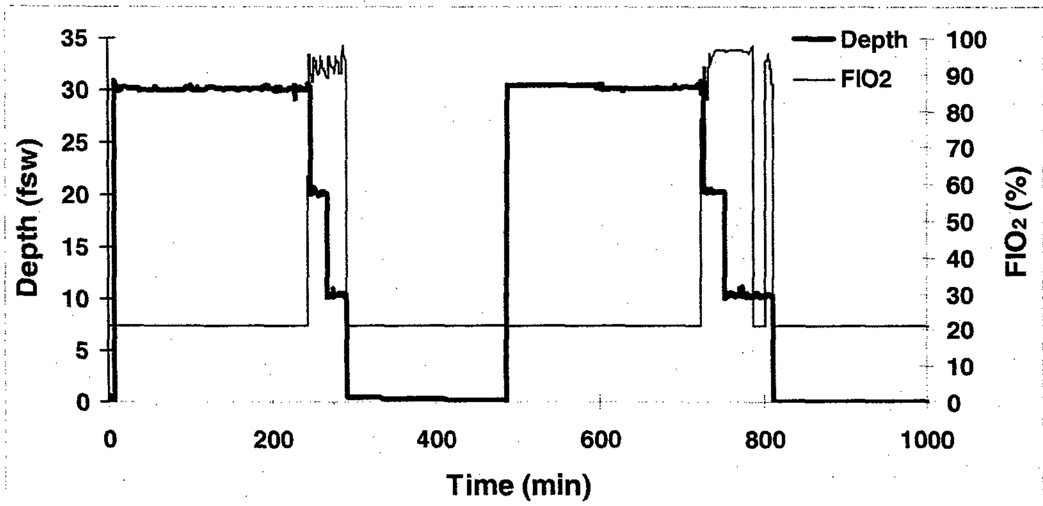

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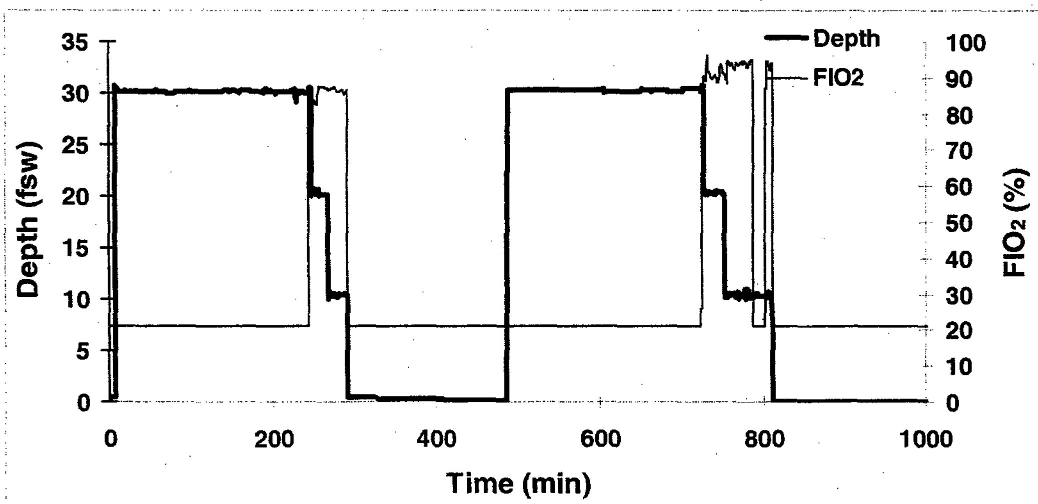

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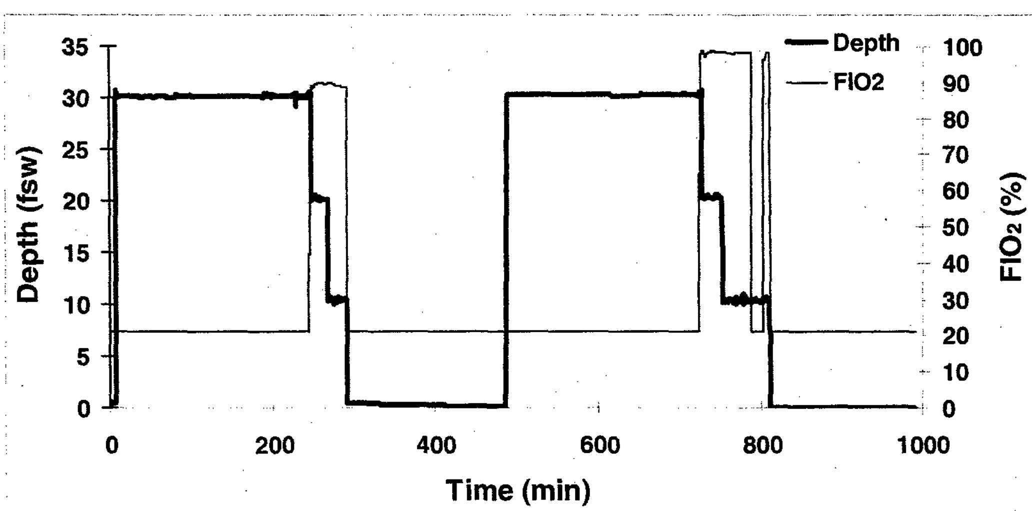

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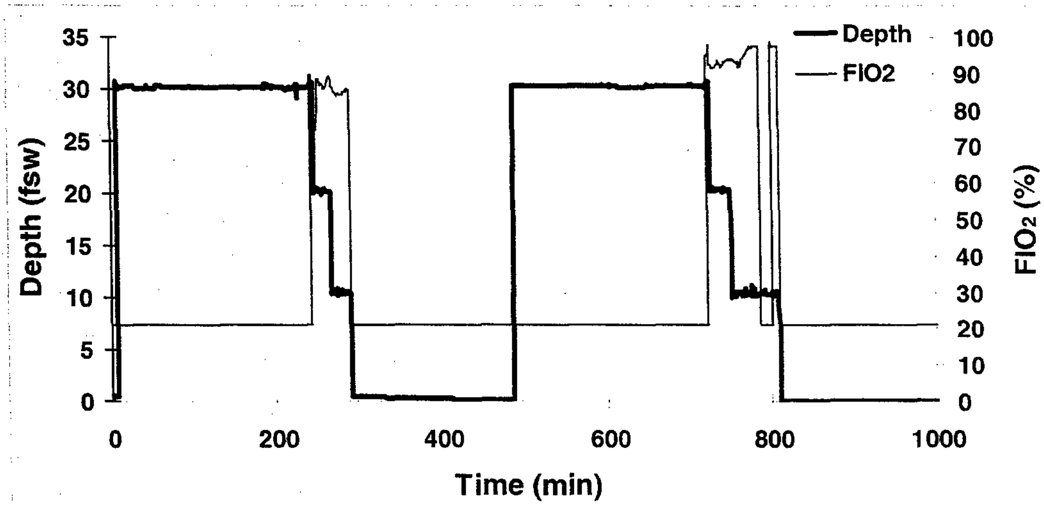

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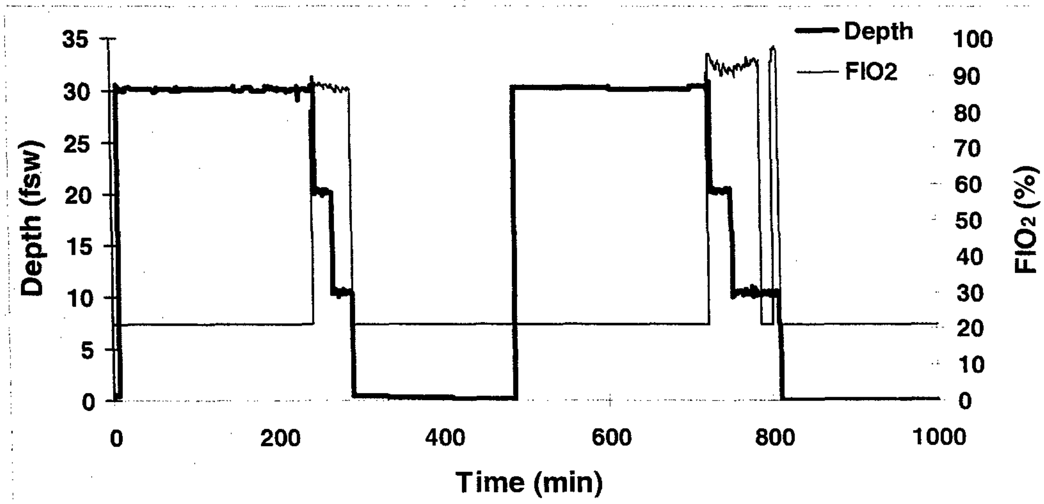

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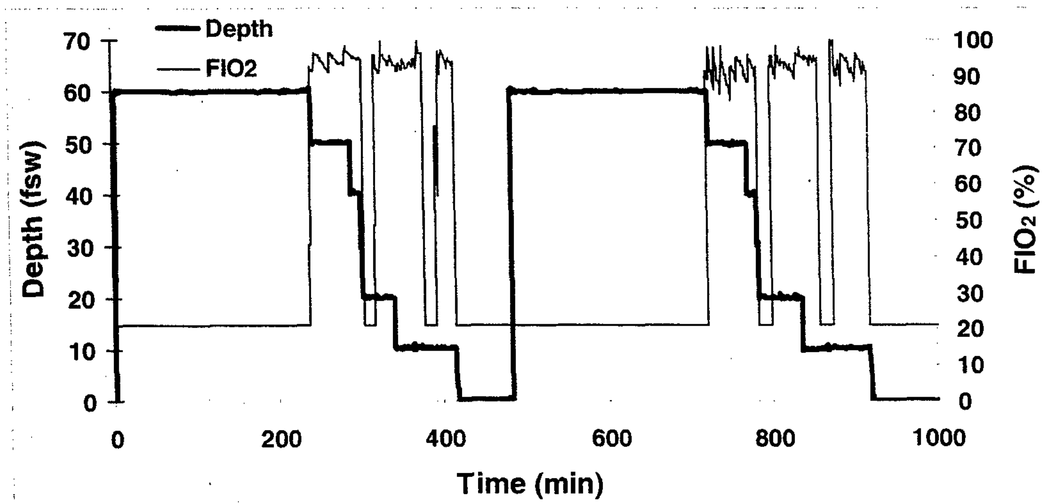

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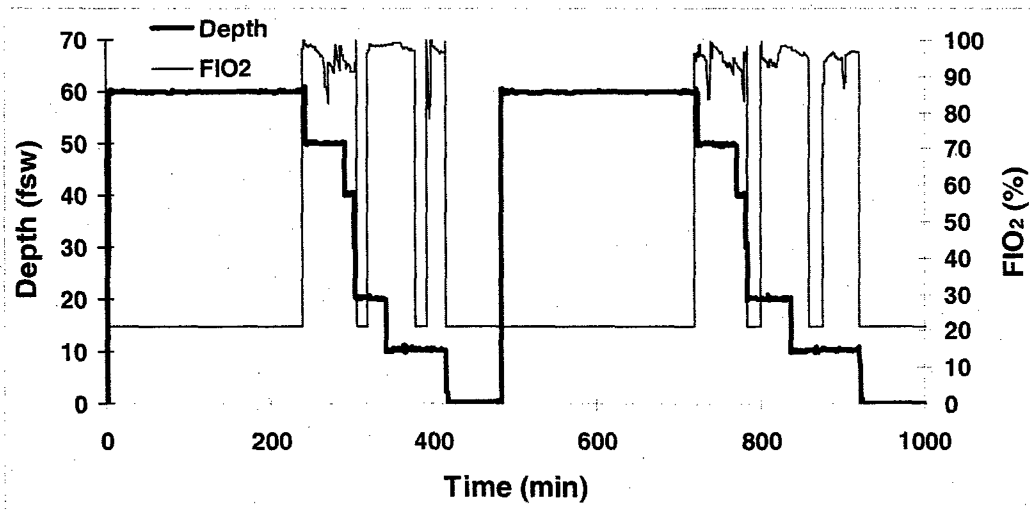

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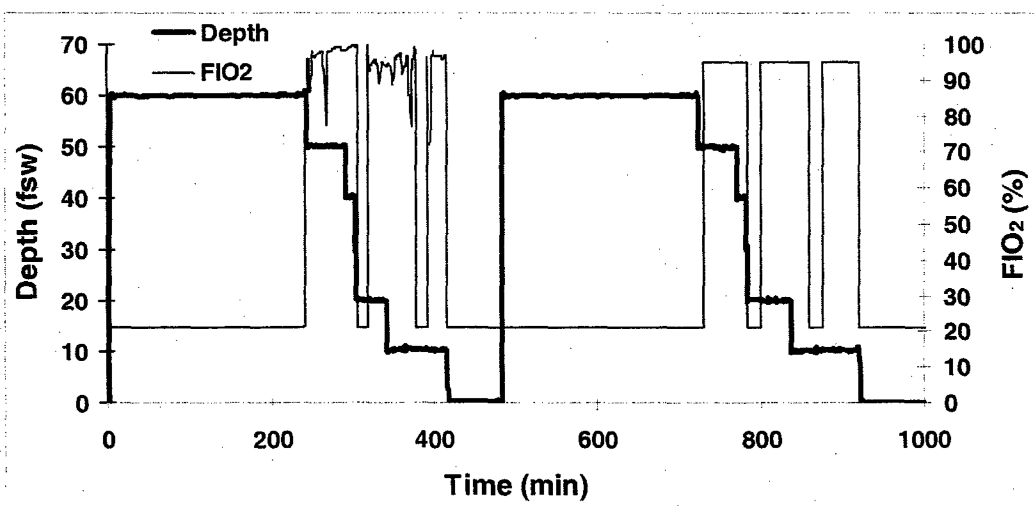

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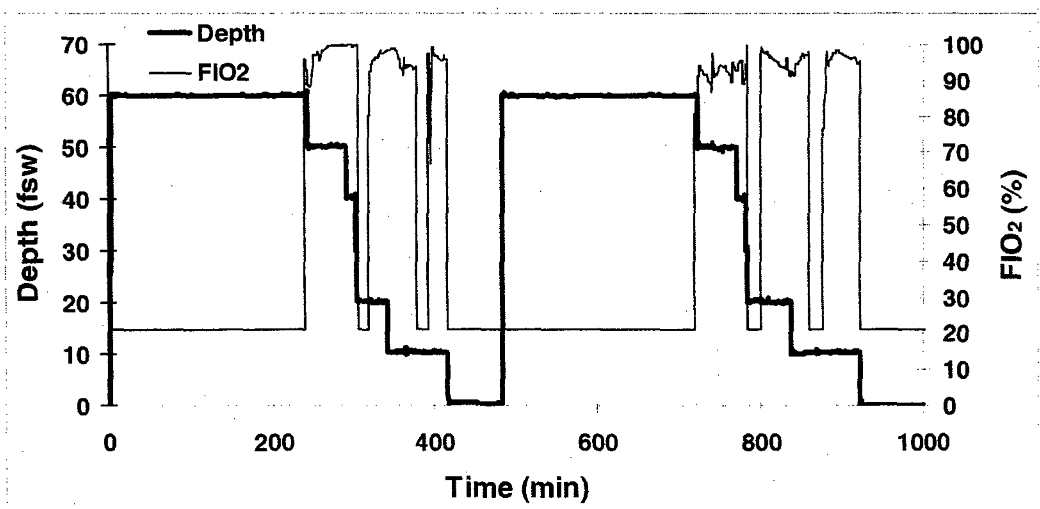

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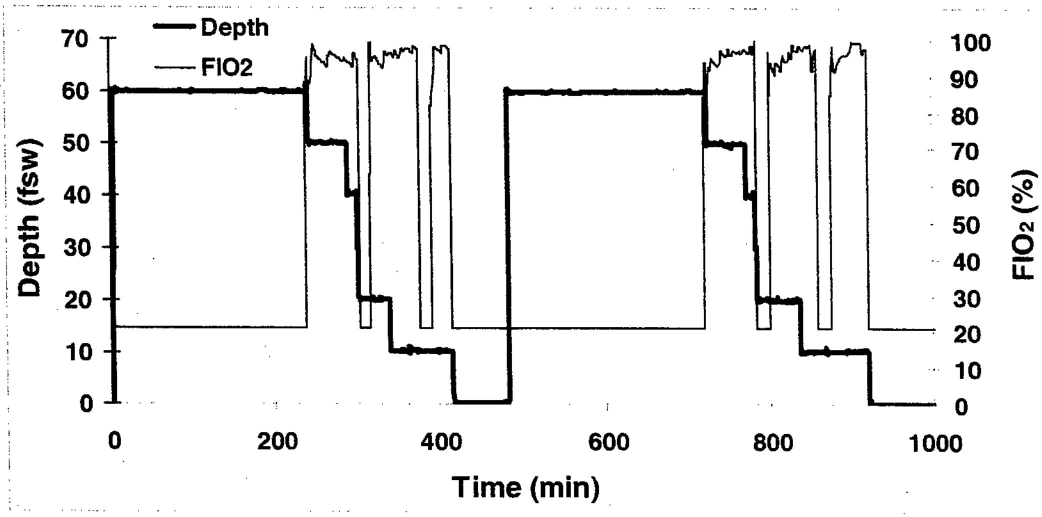

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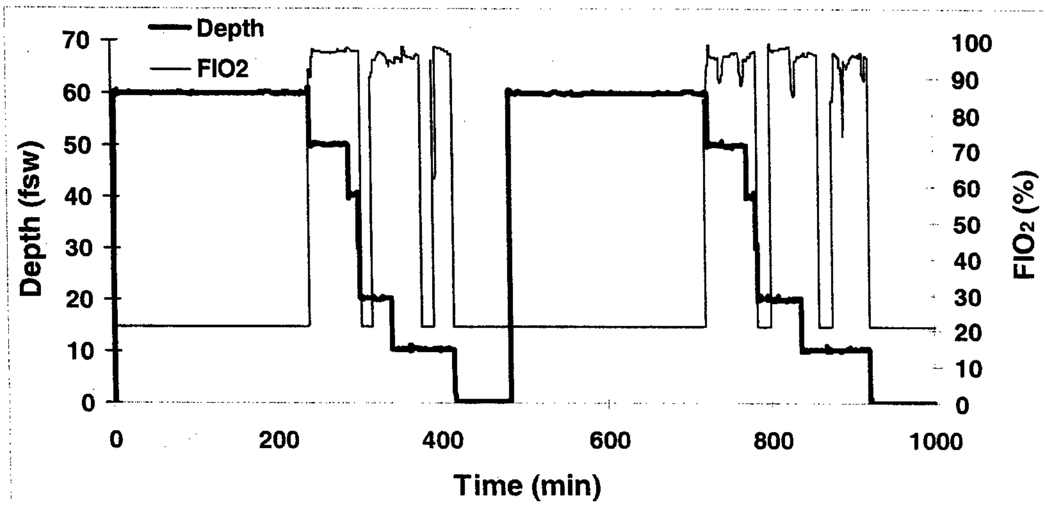

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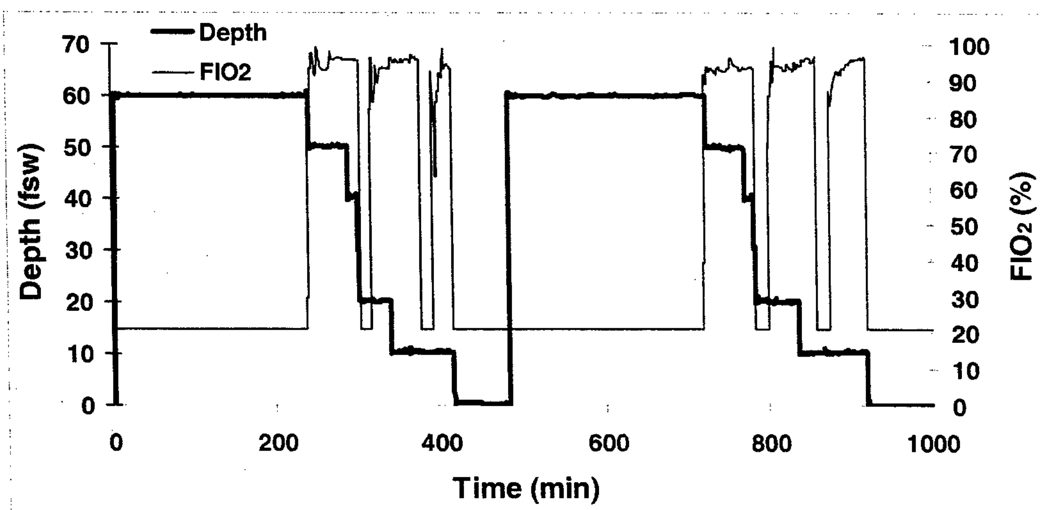

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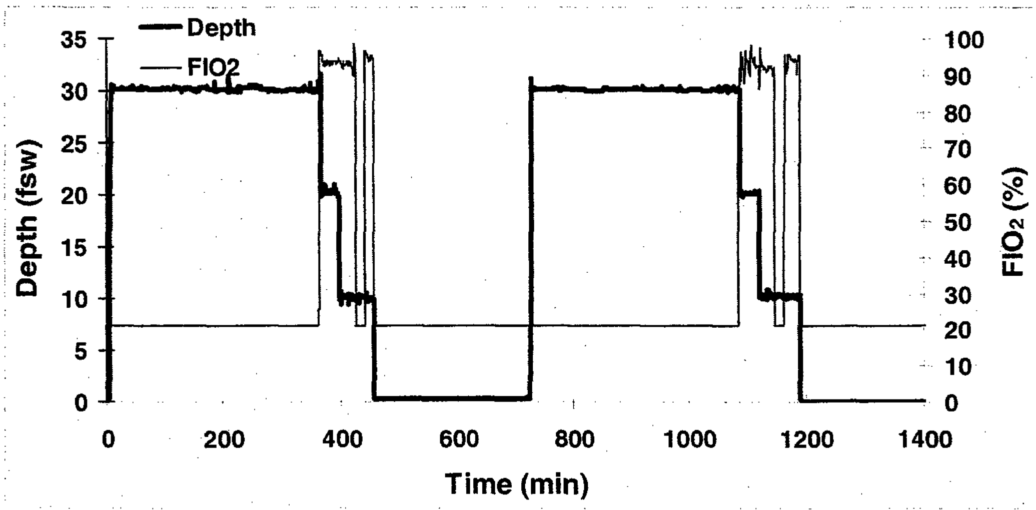

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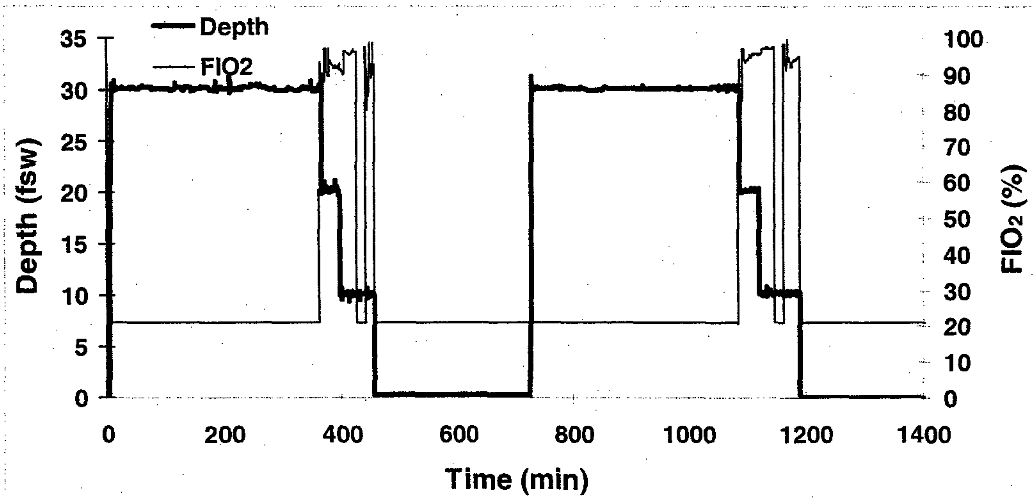

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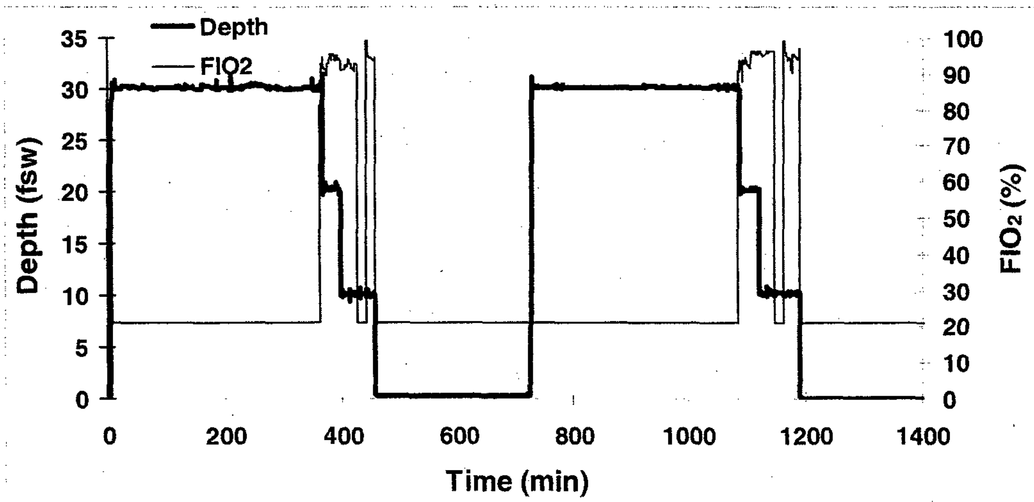

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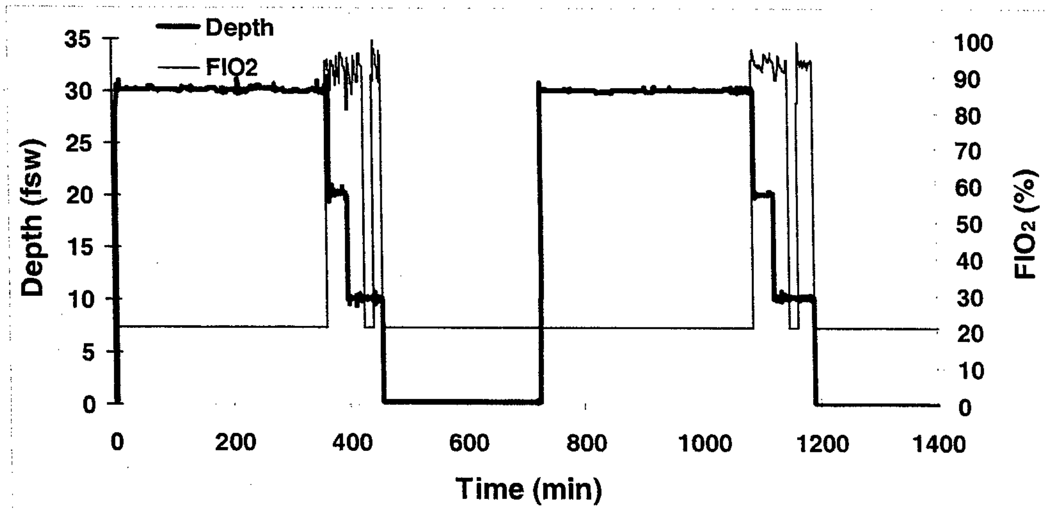

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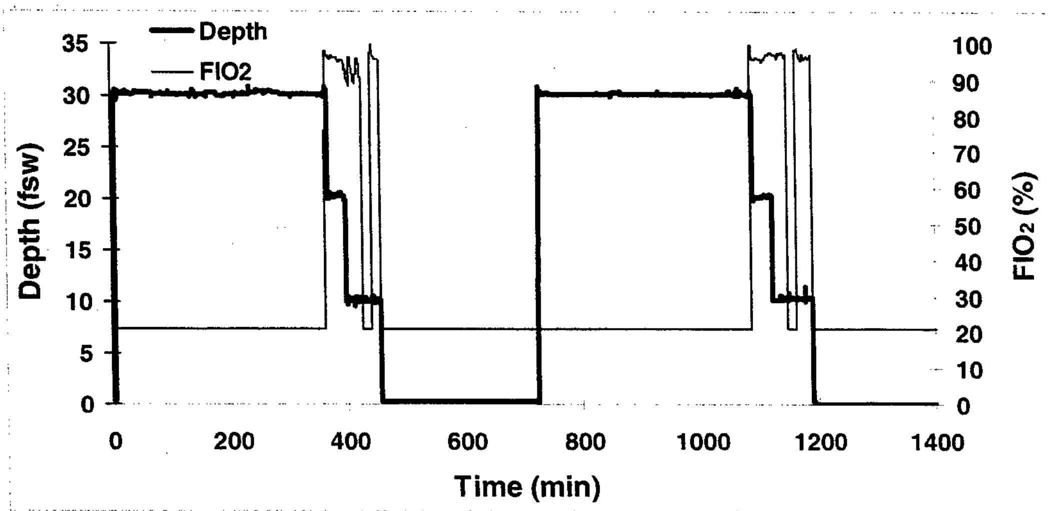

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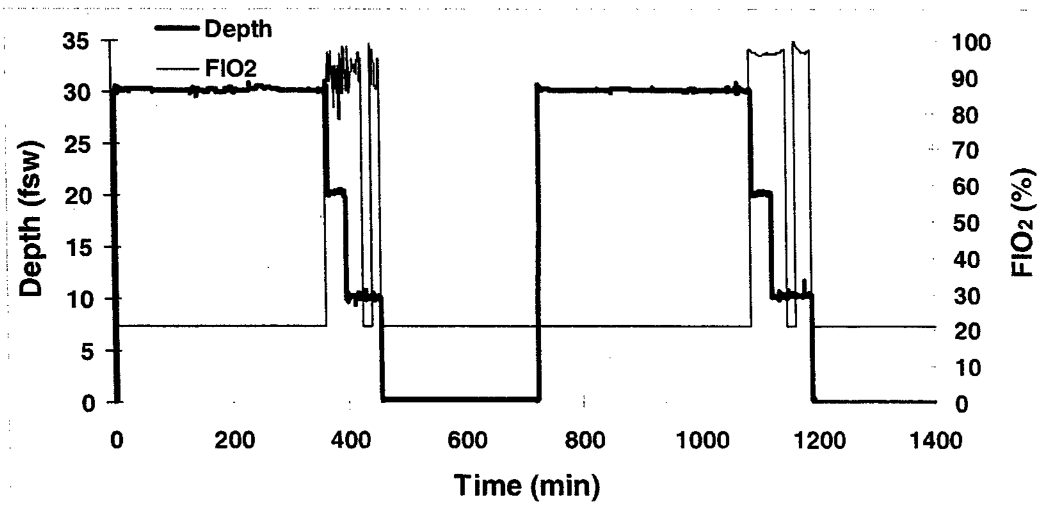

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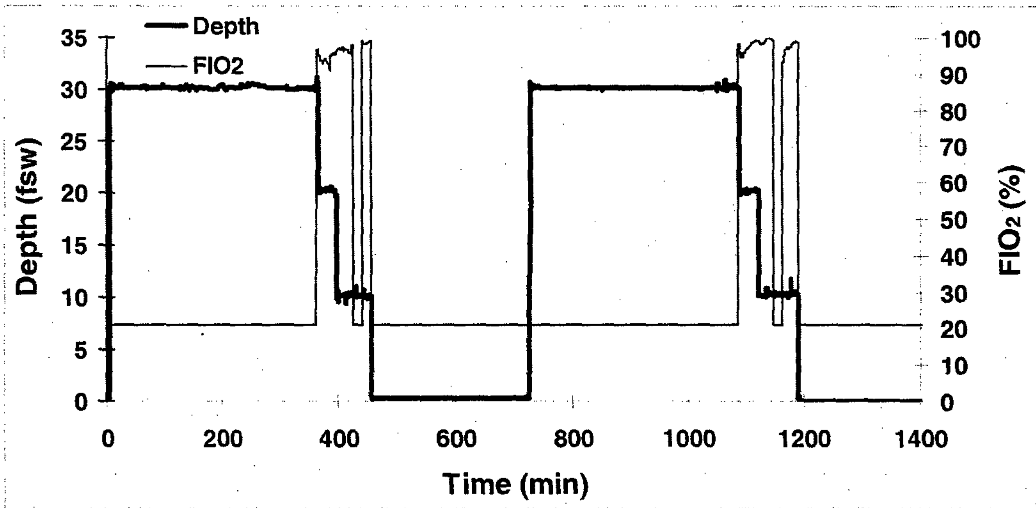

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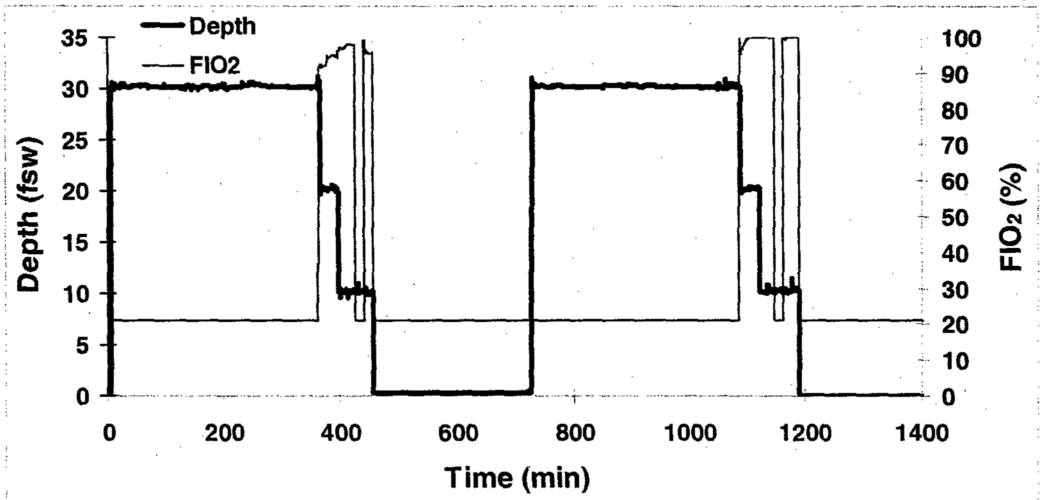

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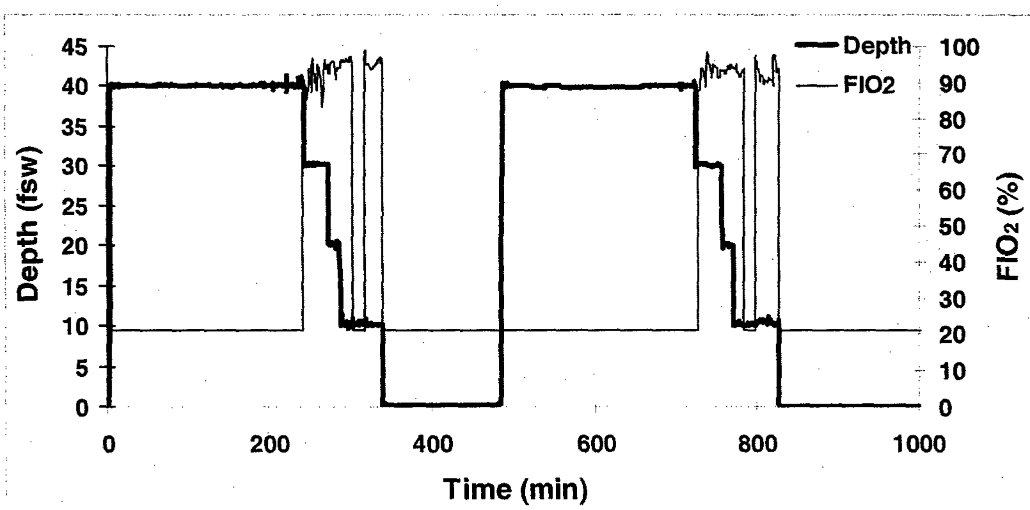

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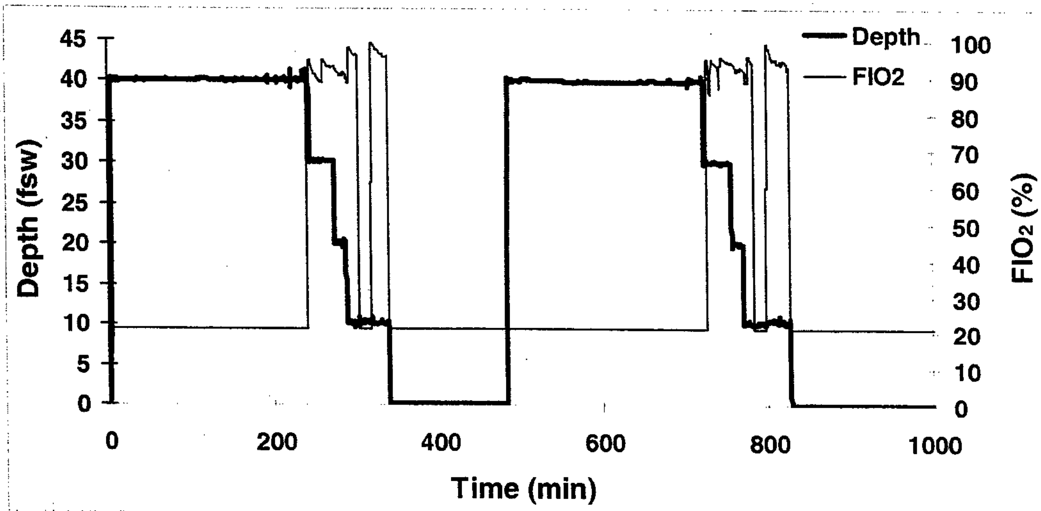

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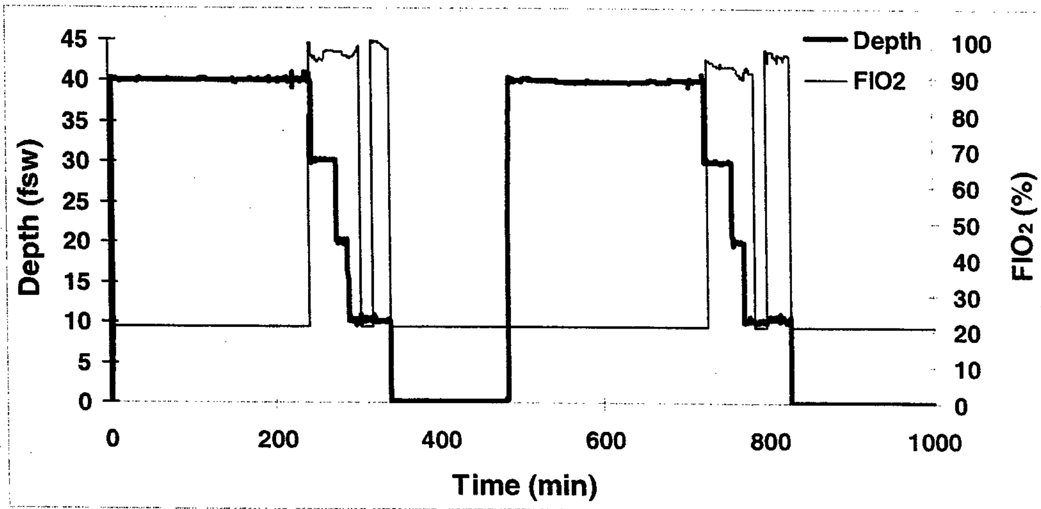

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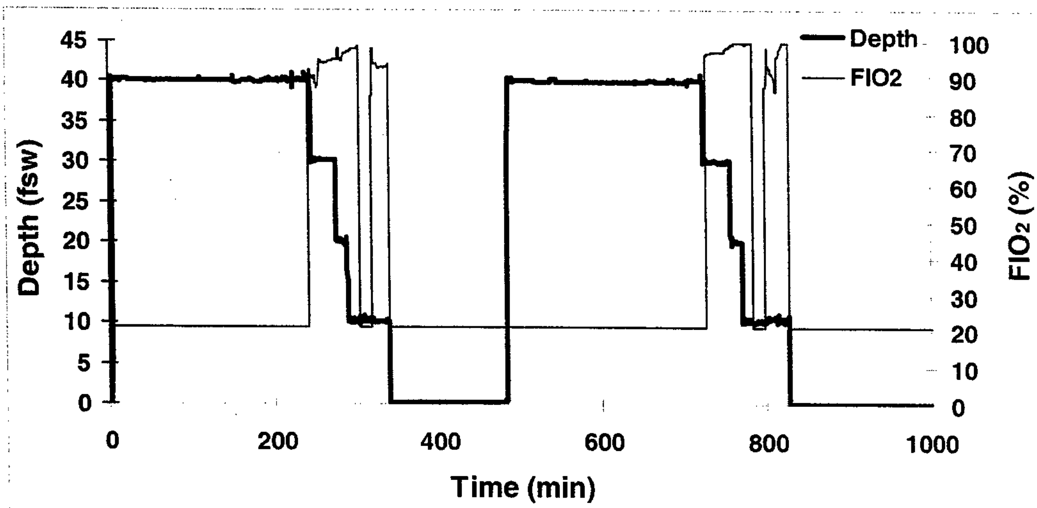

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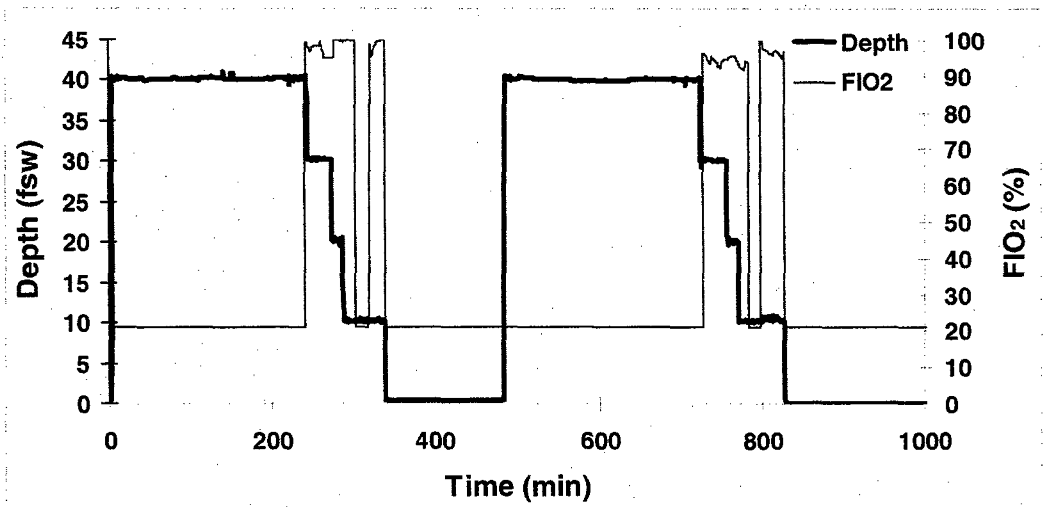

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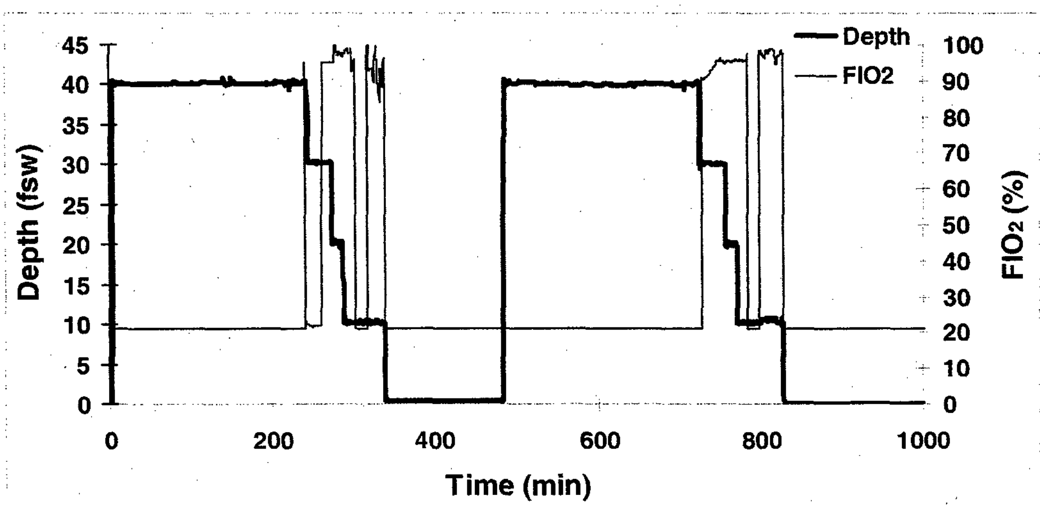

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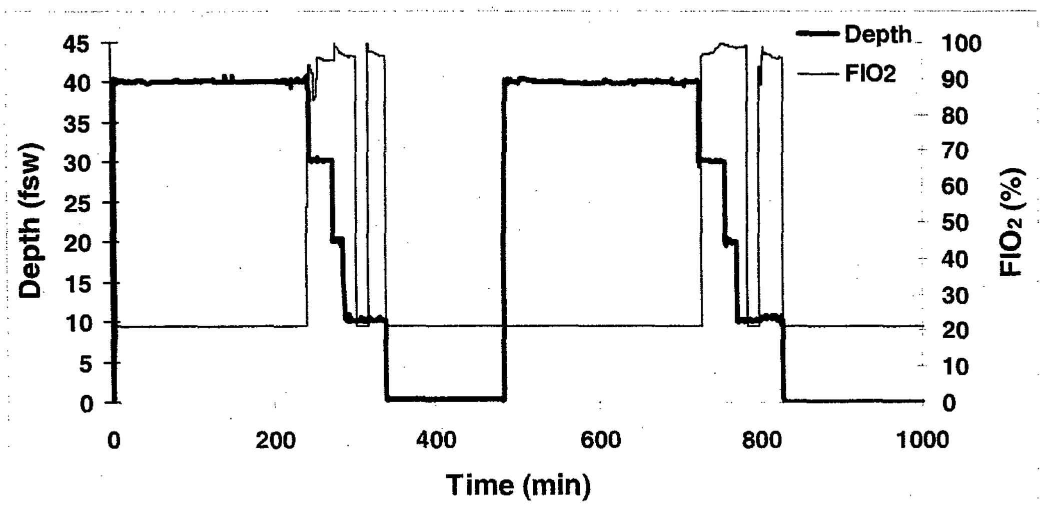

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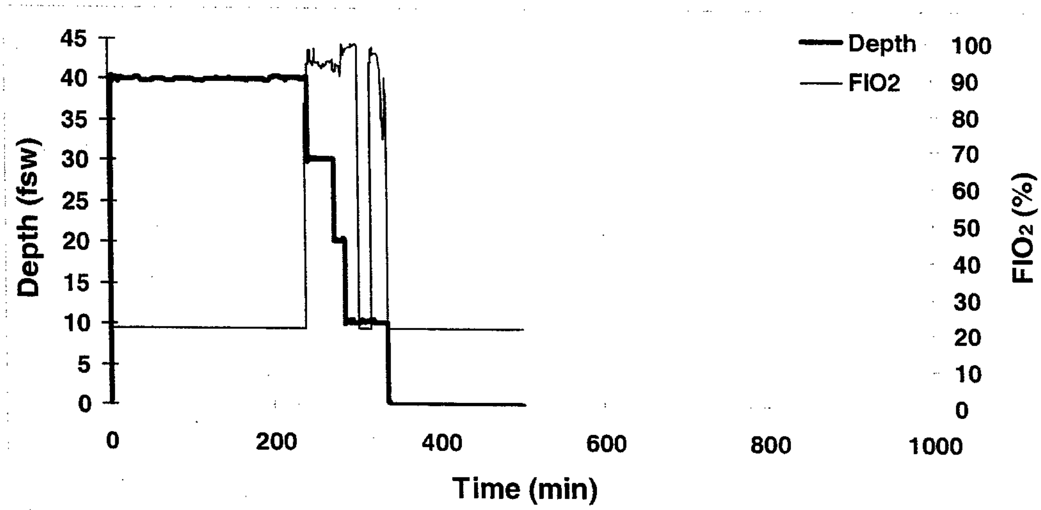

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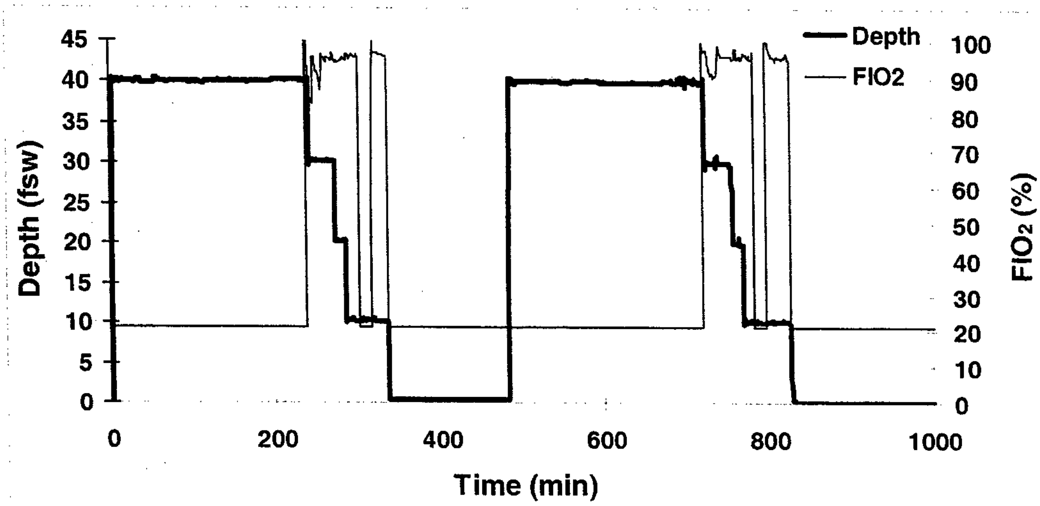

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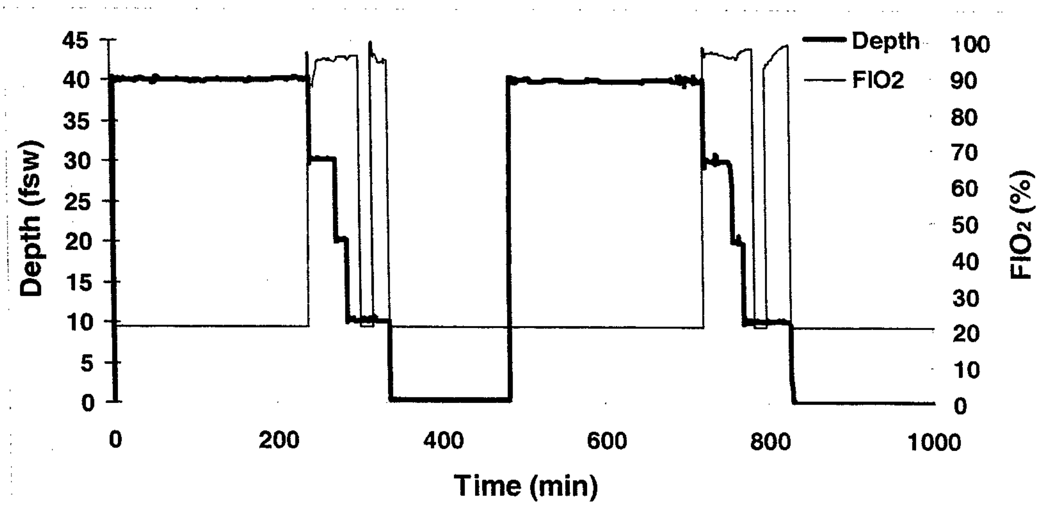

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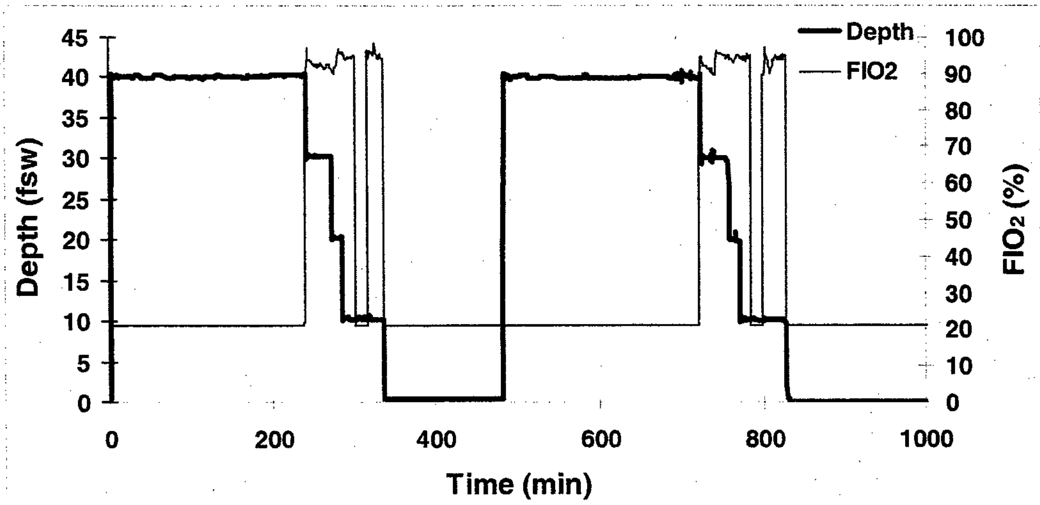

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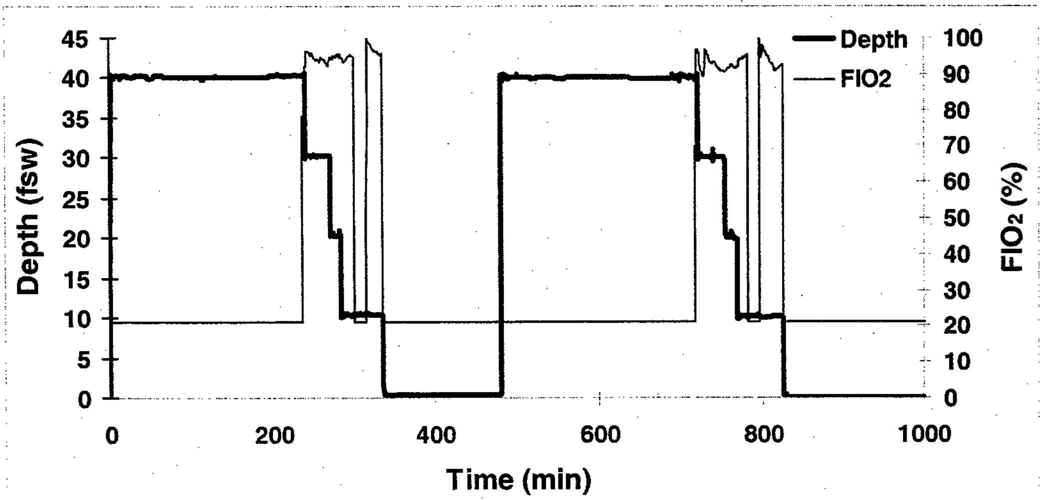

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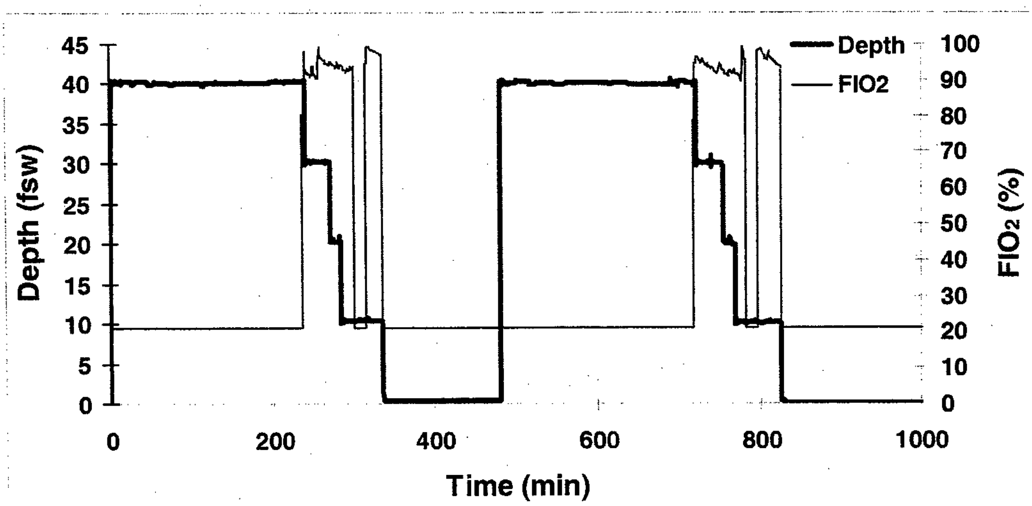

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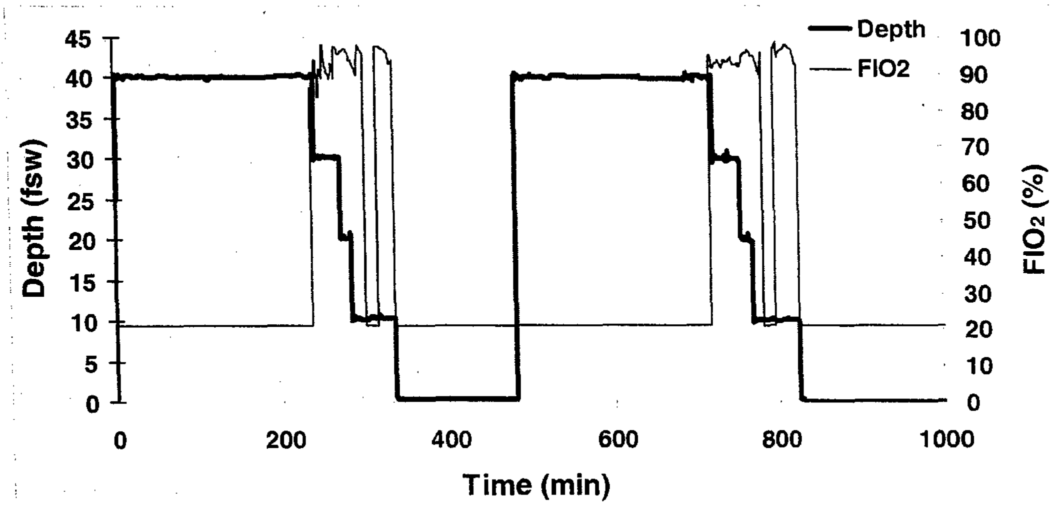

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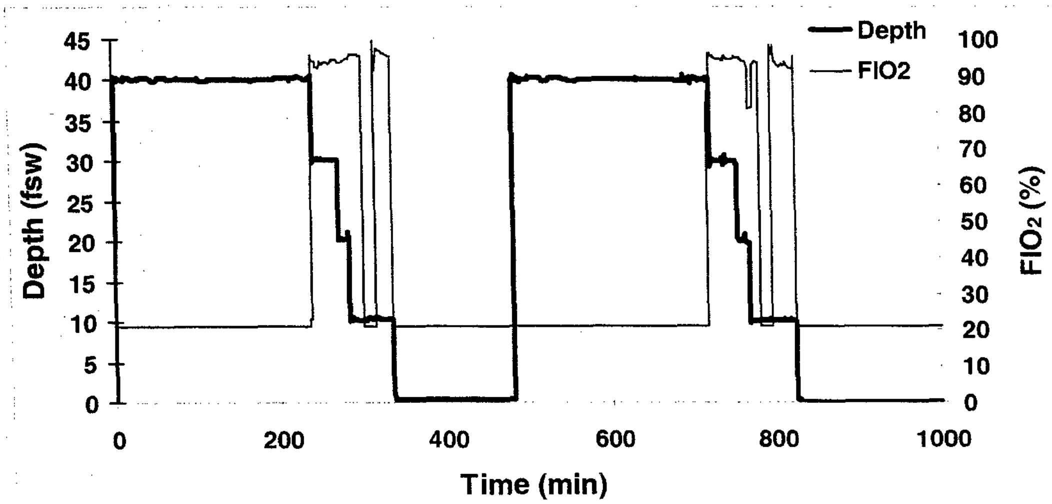

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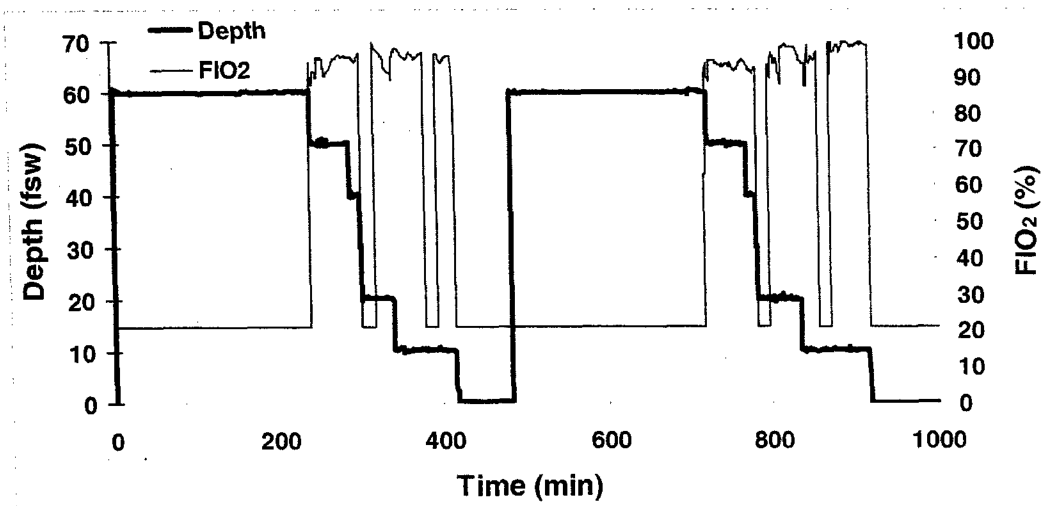

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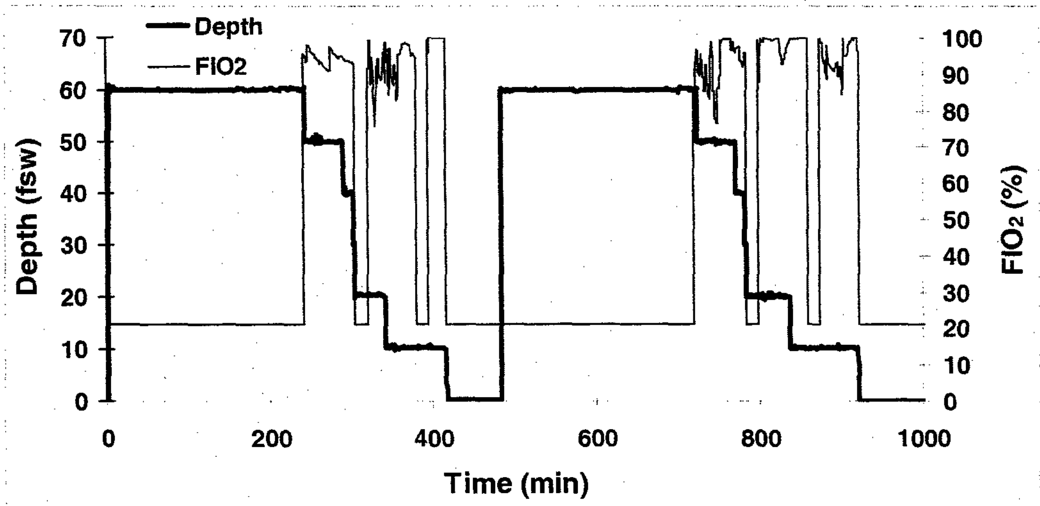

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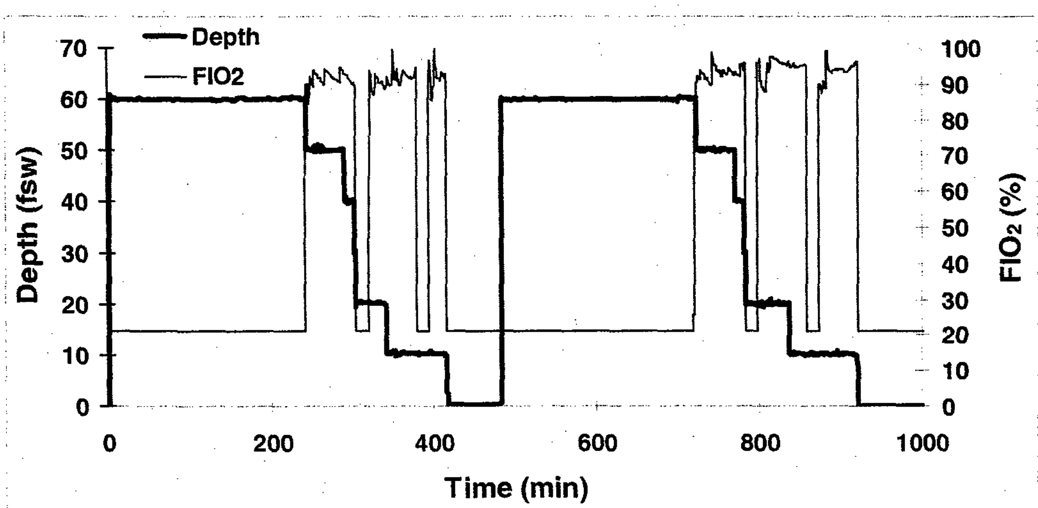

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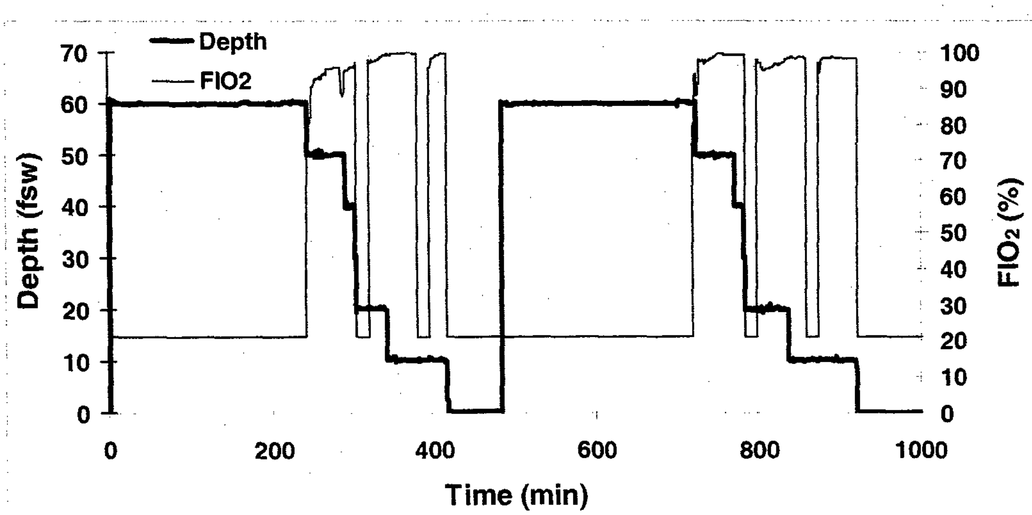

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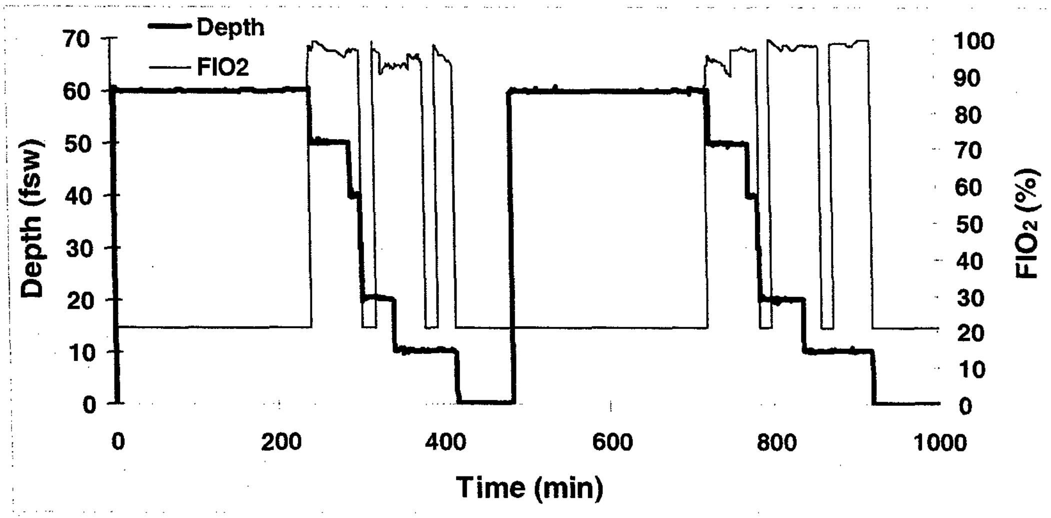

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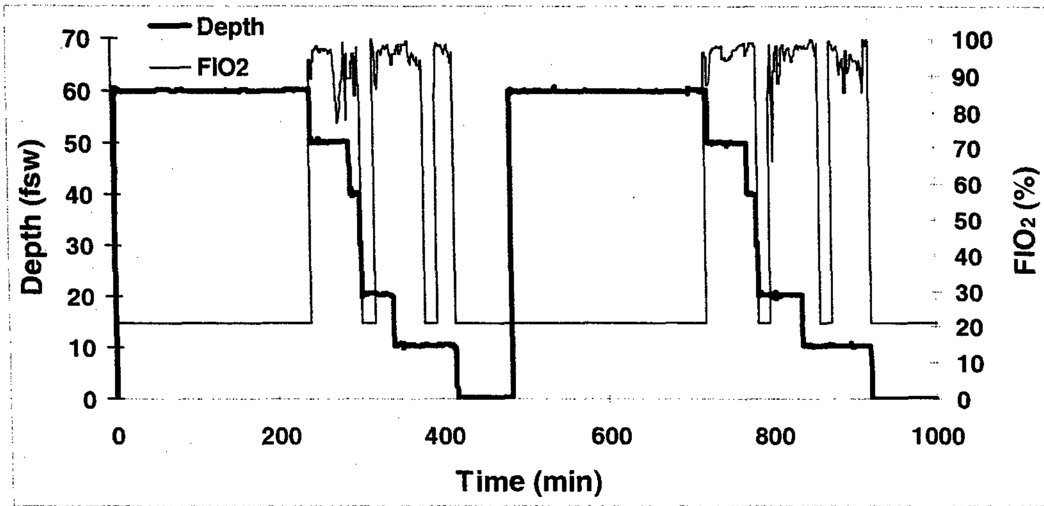

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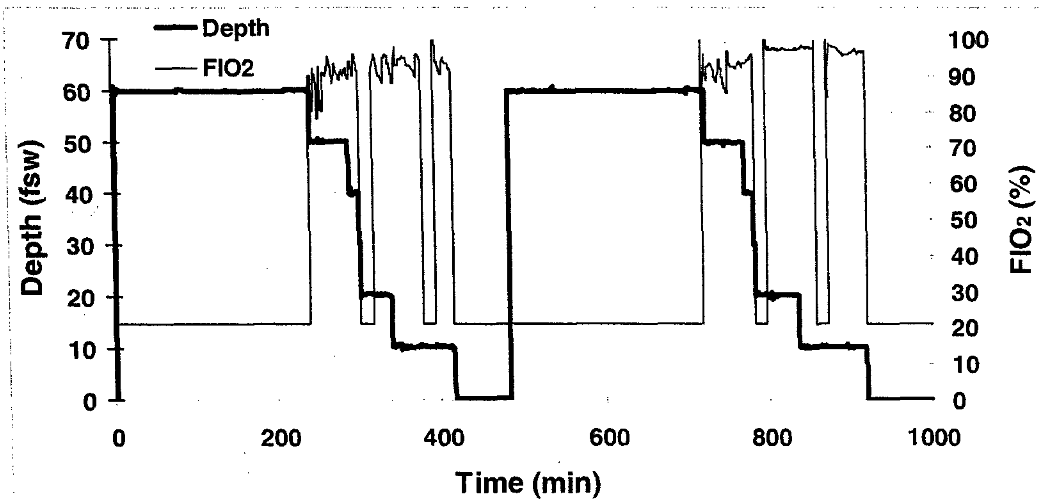

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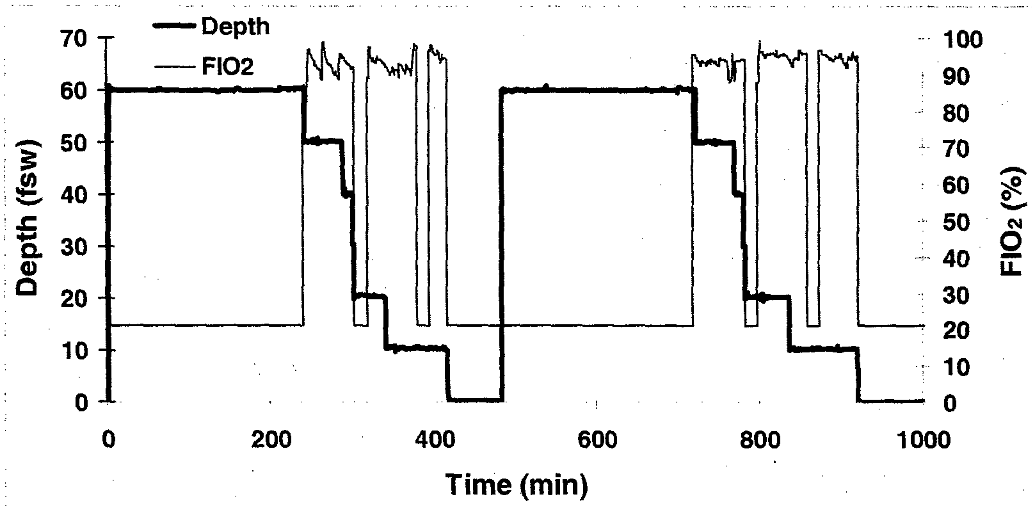

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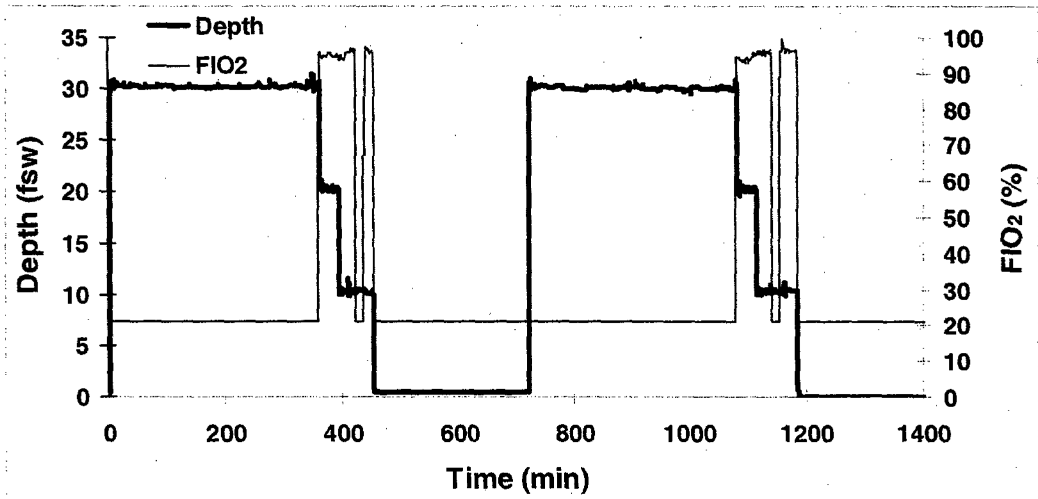

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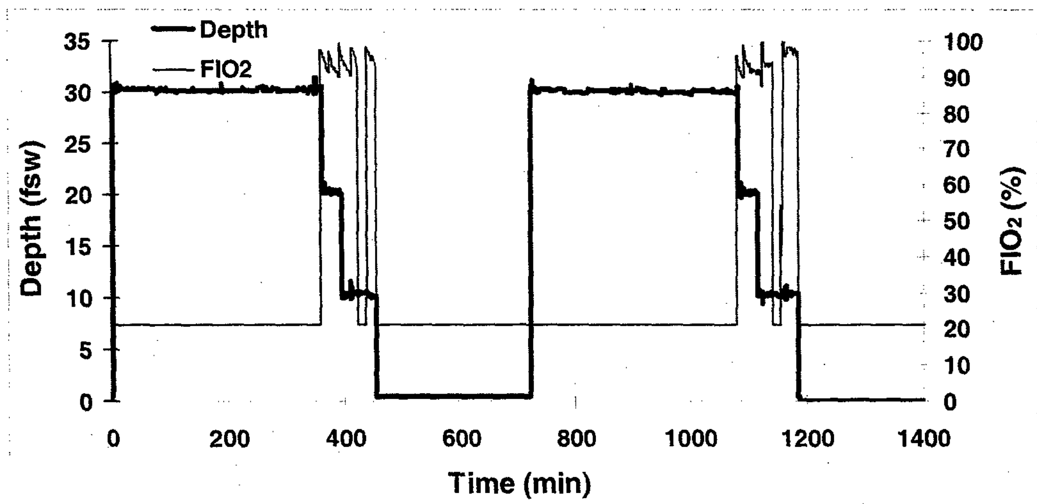

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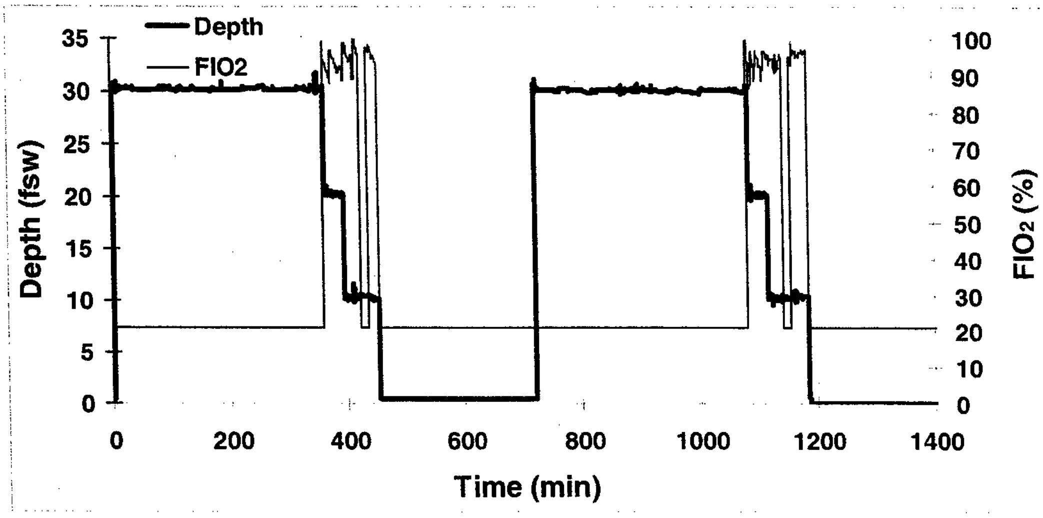

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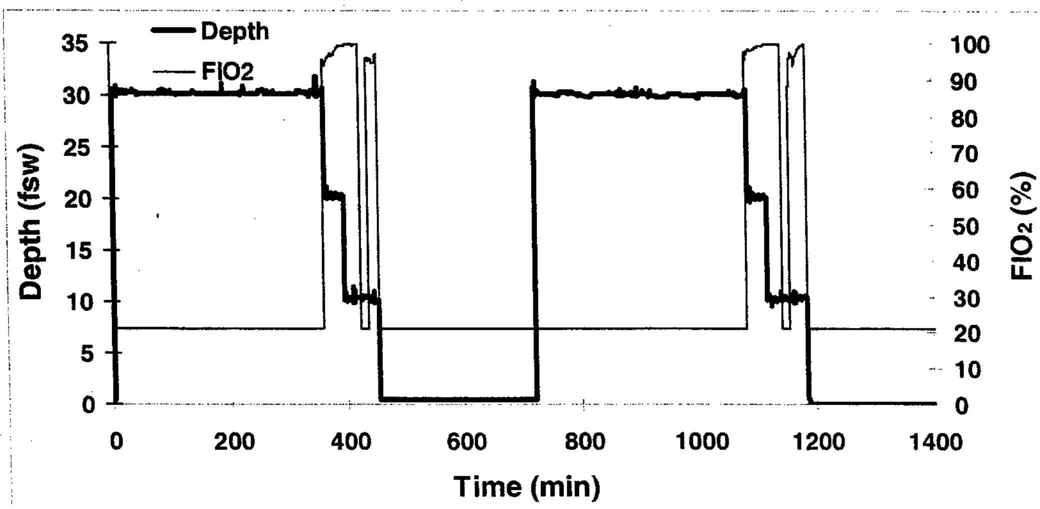

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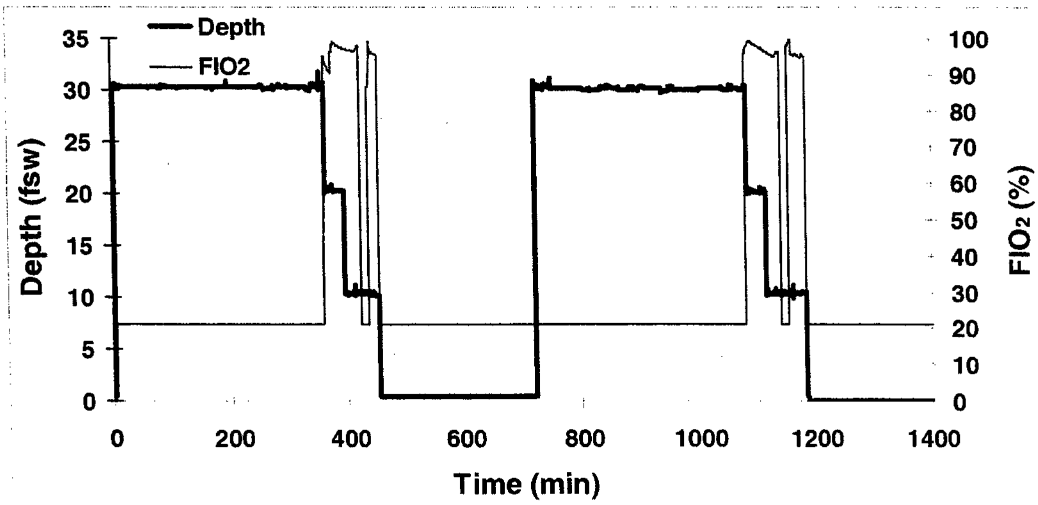

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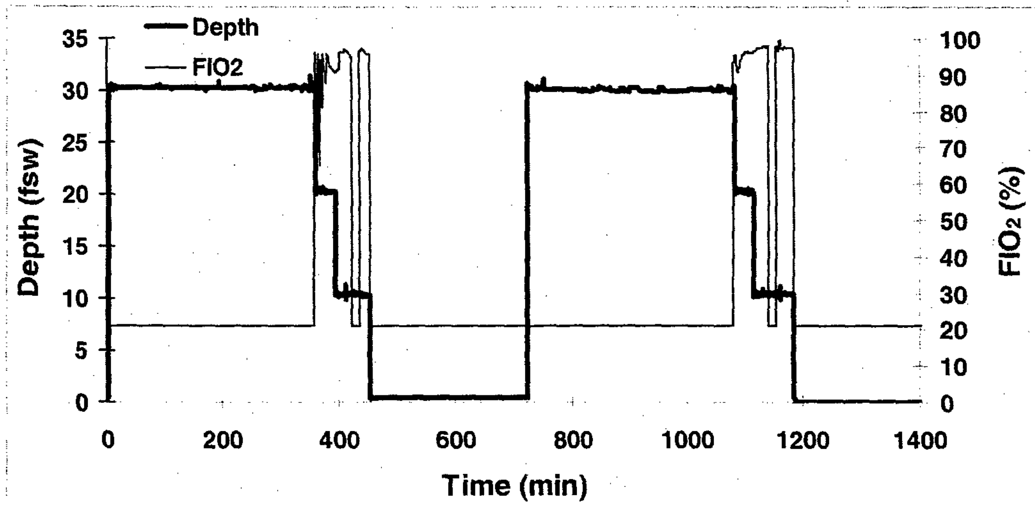

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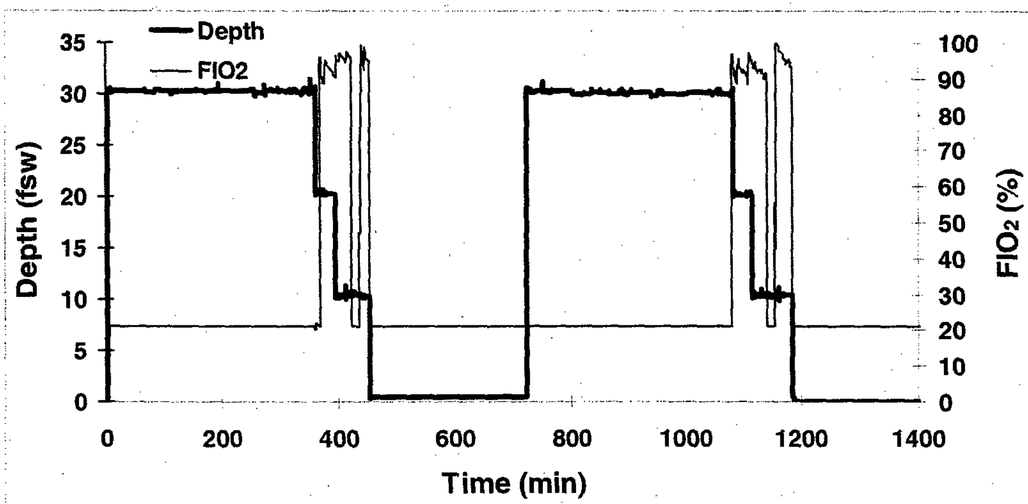

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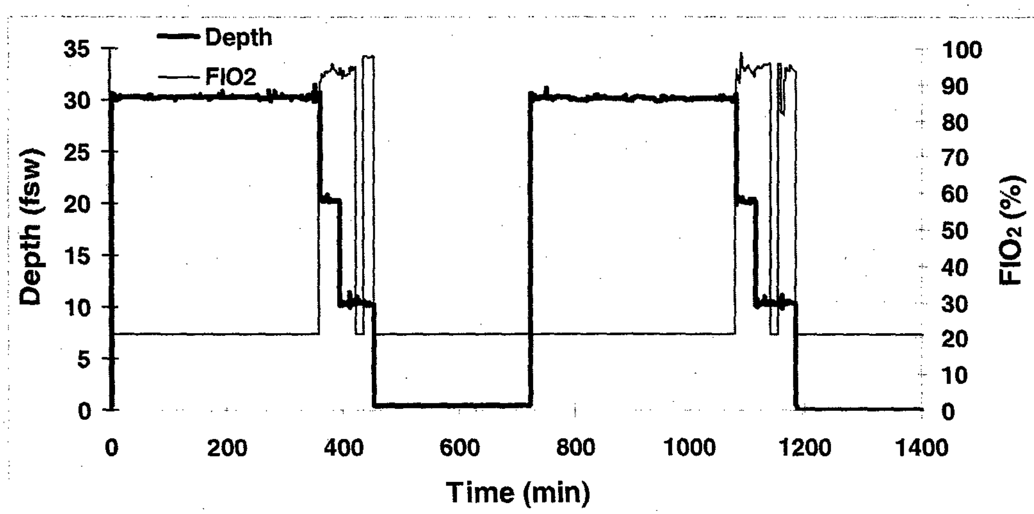

Profile 020917D09; DiverID 31

Appendix E

PARAMETERIZATION OF THE LEM PROBABILISTIC MODEL WITH EXPANDED TRAINING DATA: THE b105L3g MODEL

The Linear-Exponential Multi-Gas (LEM) probabilistic model derived in Appendix A of reference 7 formed the algorithmic basis of the NMRI98 probabilistic model of DCS incidence and time of occurrence. NMRI98 LEM parameters, with oxygen able to contribute to DCS risk when present in excess of compartment-specific threshold levels, were determined by likelihood maximization about a composite training data set of 4335 man-exposures in a wide variety of air and N_2-O_2 dives. This model was updated in present work with additional data relevant to air and N_2-O_2 decompressions in DISSUB rescue scenarios.

The training data used for the model update is summarized in Table E-1, with the data subsets contained in earlier BIG292 and NMRI98 compilations indicated in the initial entries. The compilation used here, called BIG105, included all data in these earlier compilations plus an additional eighteen data sets, twelve of which are documented by Temple, *et al.*[26,27] Four others; SIO2-85.DAT, SIO2-93.DAT, NOAA.DAT, and MOONVQ.DAT; contain data from man-dives completed at Duke University in which subjects breathed oxygen at high partial pressure during various periods of the profiles. These latter data sets were used as validation data in development of the BVM(3) model.[11,12] The remaining two data sets, EDU1100.DAT and SRDRS-OTM.DAT, contain final data from the man-dives completed to test oxygen-accelerated decompressions for air-saturated DISSUB rescuees,[1] and final data from the present man-dive series, respectively.

Parameters for the LEM model optimized about the BIG105 training data are given in Table E-2. Chi-square analyses of model goodness-of-fit to BIG105 and its composite data sets are given in Tables E-3 through E-5.

Table E-1
BIG105 Composite Training Data Set: Summary Composition

Compilation ID	Exposure Type	Data Set	# Exposures	# DCS Incidents	# DCS Marginals	Total DCS*
BIG292	Single Air	EDU885A	483	30	0	30.0
		DC4W	244	8	4	8.4
		SUBX87	58	2	0	2.0
		NMRNSW2	91	5	5	5.5
		NSM6HR	57	3	2	3.2
	Single Air, Decompression	PASA	72	5	2	5.2
	Repetitive Air	EDU885AR	182	11	0	11.0
		DC4WR	12	3	0	3.0
		PARA	135	7	3	7.3
	Multi-Level Air	PAMLA	236	13	12	14.2
	Single Non-Air	NMR8697	477	11	18	12.8
		EDU885M	81	4	0	4.0
		EDU1180S	120	10	0	10.0
	Repetitive Non-Air	EDU184	239	11	0	11.0
		EDU885S	94	4	0	4.0
	Multi-Level,SDV; PO2=0.7 Decompressions	PAMLAOD	134	6	0	6.0
	Multi-Level,SDV; PO2=0.7 Transits	PAMLAOS	140	5	3	5.3
	Air Saturation	ASATEDU	120	13	27	15.7
		ASATNSM	132	18	21	20.1
		ASATNMR	50	1	0	1.0
	Non-Air Saturation	ASATARE	165	20	13	21.3
	Subtotals		3322	190	110	201.0
NMRI98 (BIG292 +)	O2 Decompression	DC8AOW	46	3	1	3.1
		DC8AOD	256	3	2	3.2
		NMR94EOD	284	16	13	17.3
	O2 Surface Decompression	DC8ASUR	358	10	1	10.1
		DCSUREP	69	1	0	1.0
	Subtotals		1013	33	17	34.7
	Subtotals (Cumulative)		4335	223	127	235.7
BIG105 (NMRI98 +)	Single Air	EDU1351NL	143	2	7	2.7
		EDU557NL_A	568	27	0	27.0
	Sub-Sat	EDU849S	60	14	12	15.2
	Saturation	NMR9209	48	2	5	2.5
	Repetitive Non-Air	EDU1180R	128	2	0	2.0
		EDUAS45	26	8	4	8.4
		ASATDC	23	8	1	8.1

Compilation ID	Exposure Type	Data Set	# Exposures	# DCS Incidents	# DCS Marginals	Total DCS*
	Air 40/200 No-stop	NMR97NOD	103	3	4	3.4
	Air Surface Decompression	NMRASUR9 0	64	0	0	0.0
	O2 Surface Decompression	NMROSUR9 0	45	1	0	1.0
	Surface Excursion	SUREX	24	5	3	5.3
	Submarine escape	UPS290	299	4	0	4.0
	Air Sat; O2-accelerated decompression	EDU1100	182	17	0	17.0
	Repetitive Air Sub-Sat; O2-accelerated deco	SRDRS-OTM	126	3	0	3.0
	Repetitive Air, Surface O2	SIO2-85	197	4	1	4.1
		SIO2-93	38	1	0	1.0
	Repetitive Non-Air, Surface O2	NOAA	94	1	0	1.0
	Single Air; O2 Decompression	MOONVQ	69	3	3	3.3
	Subtotals		2237	105	40	109.0
	Grand Totals		**6572**	**328**	**167**	**344.7**

*Each marginal DCS counted as 0.1 DCS

Table E-2
b105L3g Model Parameters

Parameter	Value	Std. Error*
PTH2O (mm-Hg)	4.70000E+01	---
Respiratory Quotient.	1.00000E+00	---
PTCO2=PVCO2; cmpt PCO2 == Venous PCO2 (mm-Hg)	5.30000E+01	---
PTO2=PVO2; cmpt PO2 == Venous PO2 (mm-Hg)	4.60000E+01	---
PACO2; Arterial PCO2 (mm-Hg)	3.50000E+01	---
Gain/10**3 [/min], cmpt 1	4.91256E-06	2.89871E-06
Gain/10**3 [/min], cmpt 2	6.65034E-07	4.62882E-08
Gain/10**3 [/min], cmpt 3	2.20392E-07	3.59329E-08
alphab-O2 (ml/ml)	2.61000E-02	---
alphab-N2 (ml/ml)	1.58000E-02	---
PSET, O2 tracking threshold, (ATA), cmpt 1	3.55859E-01	5.96188E+00
PSET, O2 tracking threshold, (ATA), cmpt 2	1.32963E+00	9.09613E-02
PSET, O2 tracking threshold, (ATA), cmpt 3	9.90000E+01	---
TC(t) O2; exchange time constant [min], cmpt 1	2.30983E+08	2.89084E+09
TC(t) N2; exchange time constant [min], cmpt 1	1.07679E+00	4.29543E-01
TC(t) O2; exchange time constant [min], cmpt 2	4.75410E+02	3.57563E+02
TC(t) N2; exchange time constant [min], cmpt 2	2.24785E+02	6.57120E+00
TC(t) O2; exchange time constant [min], cmpt 3	1.00000E+00	---
TC(t) N2; exchange time constant [min], cmpt 3	1.02965E+03	4.89153E+01
PXO(t); E->L kinetic threshold (atm), cmpt 1	1.00000E+10	---
PXO(t); E->L kinetic threshold (atm), cmpt 2	3.35148E-01	2.64908E-02
PXO(t); E->L kinetic threshold (atm), cmpt 3	1.00000E+10	---
THR(t); risk threshold [atm], in cmpt 1	0.00000E+00	---
THR(t); risk threshold [atm], in cmpt 2	1.73761E-02	1.55578E-03
THR(t); risk threshold [atm], in cmpt 3	8.30956E-02	4.69004E-03

*Values with no Std Error were fixed during optimization at values shown

Table E-3
Group-Specific and Global Chi-Square Goodness-of-fit of B105L3g Model to BIG105 Composite Data Set

Data Set	# Exposures	# DCS Incidents				
		Observed	Predicted	95% CL		
			B105L3g			Pearson Residual
	(N)	(f)	n	(Low - High)	π	(f-n)^2/n(1-π)
EDU885A	483	30	23.28	20.41 - 26.46	0.05	2.035
DC4W	244	8.4	4.89	3.76 - 6.52	0.02	2.569
SUBX87	58	2	0.74	0.27 - 1.74	0.01	2.179
NMRNSW	91	5.5	5.78	5.11 - 6.50	0.06	0.014
NSM6HR	57	3.2	4.47	3.97 - 5.01	0.08	0.393
PASA	72	5.2	2.80	2.37 - 3.27	0.04	2.150
EDU885AR	182	11	10.01	8.39 - 11.84	0.05	0.104
DC4WR	12	3	0.73	0.64 - 0.83	0.06	7.549
PARA	135	7.3	9.28	7.70 - 11.08	0.07	0.454
PAMLA	236	14.2	17.87	15.87 - 20.01	0.08	0.814
NMR8697	477	12.8	17.36	15.02 - 19.97	0.04	1.245
EDU885M	81	4	3.05	2.68 - 3.45	0.04	0.311
EDU1180S	120	10	6.85	6.04 - 7.72	0.06	1.540
EDU184	239	11	12.65	10.97 - 14.50	0.05	0.227
EDU885S	94	4	4.15	3.65 - 4.69	0.04	0.006
PAMLAOD	134	6	7.26	6.40 - 8.20	0.05	0.231
PAMLAOS	140	5.3	6.12	5.26 - 7.07	0.04	0.114
ASATEDU	120	15.7	15.67	12.99 - 18.62	0.13	0.000
ASATNSM	132	20.1	23.99	20.11 - 28.14	0.18	0.771
ASATNMR	50	1	4.17	3.69 - 4.68	0.08	2.624
ASATARE	165	21.3	19.64	16.96 - 22.51	0.12	0.160
DC8AOW	46	3.1	1.26	1.07 - 1.48	0.03	2.742
DC8AOD	256	3.2	6.51	5.33 - 7.90	0.03	1.728
NMR94EOD	284	17.3	17.67	13.65 - 22.45	0.06	0.008
DC8ASUR	358	10.1	12.23	9.16 - 16.04	0.03	0.385
DCSUREP	69	1	3.22	2.62 - 3.91	0.05	1.605
EDU1351NL	143	2.7	3.25	2.55 - 4.20	0.02	0.097
EDU557NL_A	568	27	26.28	22.37 - 30.89	0.05	0.021
EDU849S	60	15.2	8.67	7.68 - 9.72	0.14	5.756
NMR9209	48	2.5	3.55	3.14 - 3.99	0.07	0.333
EDU1180R	128	2	11.77	10.42 - 13.23	0.09	8.935

Data Set	# Exposures	# DCS Incidents				
		Observed	Predicted	95% CL		
			B105L3g			Pearson Residual
	(N)	(f)	n	(Low - High)	π	$(f-n)^2/n(1-\pi)$
EDUAS45	26	8.4	5.26	4.69 - 5.86	0.20	2.350
ASATDC	23	8.1	2.64	2.35 - 2.95	0.11	12.765
NMR97NOD	103	3.4	5.41	4.81 - 6.07	0.05	0.791
NMRASUR90	64	0	4.33	3.82 - 4.87	0.07	4.643
NMROSUR90	45	1	2.28	1.88 - 2.73	0.05	0.756
SUREX	24	5.3	4.20	3.54 - 4.91	0.18	0.349
UPS290	299	4	4.54	1.20 - 15.28	0.02	0.065
EDU1100	182	17	6.97	5.31 - 8.97	0.04	15.023
SRDRS-OTM	126	3	3.05	2.21 - 4.09	0.02	0.001
SIO2-85	197	4.1	6.53	5.69 - 7.45	0.03	0.933
SIO2-93	38	1	1.18	1.03 - 1.36	0.03	0.029
NOAA	94	1	2.73	1.94 - 3.80	0.03	1.127
MOONVQ	69	3.3	1.13	0.61 - 2.09	0.02	4.214
Totals	6572	344.7	344.81		$\chi^2=$	90.147
					df=42	P=0.0000

Excluding EDU1100:	$\chi^2=$	75.123
	(df=41)	P=0.0009

Table E-4
Group-Specific and Global Chi-Square Goodness-of-fit of NMRI98 Model to BIG105 Composite Data Set

Data Set	# Exposures	# DCS Incidents				
		Observed	Predicted NMRI98	95% CL		Pearson Residual
	(N)	(f)	n	(Low - High)	π	(f-n)^2/n(1-π)
EDU885A	483	30	27.29	22.49 - 32.74	0.06	0.284
DC4W	244	8.4	5.74	4.301 - 7.525	0.02	1.260
SUBX87	58	2	0.72	0.176 - 2.082	0.01	2.331
NMRNSW	91	5.5	5.49	4.492 - 6.62	0.06	0.000
NSM6HR	57	3.2	4.11	3.531 - 4.736	0.07	0.215
PASA	72	5.2	2.78	2.237 - 3.416	0.04	2.189
EDU885AR	182	11	11.38	9.296 - 13.739	0.06	0.013
DC4WR	12	3	0.97	0.807 - 1.156	0.08	4.604
PARA	135	7.3	9.46	7.649 - 11.535	0.07	0.530
PAMLA	236	14.2	18.31	15.843 - 20.998	0.08	1.001
NMR8697	477	12.8	16.58	12.822 - 21.071	0.03	0.892
EDU885M	81	4	3.00	2.43 - 3.648	0.04	0.350
EDU1180S	120	10	6.80	5.621 - 8.123	0.06	1.601
EDU184	239	11	12.64	10.24 - 15.399	0.05	0.224
EDU885S	94	4	3.83	3.152 - 4.622	0.04	0.008
PAMLAOD	134	6	7.61	6.454 - 8.887	0.06	0.360
PAMLAOS	140	5.3	5.99	5.143 - 6.933	0.04	0.084
ASATEDU	120	15.7	14.87	12.373 - 17.609	0.12	0.053
ASATNSM	132	20.1	22.07	18.405 - 26.013	0.17	0.210
ASATNMR	50	1	4.57	3.897 - 5.304	0.09	3.068
ASATARE	165	21.3	18.81	15.941 - 21.931	0.11	0.372
DC8AOW	46	3.1	1.35	0.952 - 1.855	0.03	2.337
DC8AOD	256	3.2	6.51	4.484 - 9.177	0.03	1.727
NMR94EOD	284	17.3	14.32	10.78 - 18.717	0.05	0.652
DC8ASUR	358	10.1	10.36	6.691 - 15.305	0.03	0.007
DCSUREP	69	1	2.79	1.946 - 3.879	0.04	1.198
Following data sets not included in NMRI98 model training data:						
EDU1351NL	143	2.7	3.39	2.579 - 4.366	0.02	0.142
EDU557NL_A	568	27	35.50	28.29 - 43.853	0.06	2.172
EDU849S	60	15.2	9.56	8.28 - 10.929	0.16	3.953
NMR9209	48	2.5	3.86	3.29 - 4.488	0.08	0.522

Data Set	# Exposures	# DCS Incidents				
		Observed	Predicted	95% CL		
			NMRI98			
						Pearson Residual
	(N)	(f)	n	(Low - High)	π	(f-n)^2/n(1-π)
EDU1180R	128	2	12.36	10.62 - 14.247	0.10	9.609
EDUAS45	26	8.4	5.88	5.085 - 6.719	0.23	1.391
ASATDC	23	8.1	3.24	2.783 - 3.736	0.14	8.468
NMR97NOD	103	3.4	4.28	3.467 - 5.214	0.04	0.189
NMRASUR90	64	0	4.58	3.839 - 5.394	0.07	4.927
NMROSUR90	45	1	1.86	1.413 - 2.396	0.04	0.415
SUREX	24	5.3	4.22	3.577 - 4.896	0.18	0.339
UPS290	299	4	4.59	1.525 - 11.223	0.02	0.078
EDU1100	182	17	0.88	0.611 - 18.772	0.00	295.611
SRDRS-OTM	126	3	2.18	1.573 - 3.002	0.02	0.315
SIO2-85	197	4.1	3.65	2.628 - 4.949	0.02	0.056
SIO2-93	38	1	0.64	0.453 - 0.884	0.02	0.205
NOAA	94	1	3.13	2.116 - 4.456	0.03	1.497
MOONVQ	69	3.3	0.85	0.245 - 2.52	0.01	7.207
Totals	6572	344.7	342.98		χ^2=	362.662
					df=42	P=0.0000

Excluding EDU1100:	χ^2=	67.052
	df=41	P=0.0063

Table E-5
Group-Specific and Global Chi-Square Goodness-of-fit of BVM(3) Model to BIG105 Composite Data Set

Data Set	# Exposures	# DCS Incidents				
		Observed	Predicted	95% CL		
			BVM(3)			Pearson Residual
	(N)	(f)	n	(Low - High)	π	(f-n)^2/n(1-π)
EDU885A	483	30	27.01	19.60 - 37.87	0.06	0.350
DC4W	244	8.4	7.38	4.88 - 16.708	0.03	0.147
SUBX87	58	2	0.67	0.21 - 3.78	0.01	2.695
NMRNSW	91	5.5	4.23	3.56 - 4.973	0.05	0.402
NSM6HR	57	3.2	3.29	2.711 - 3.968	0.06	0.002
PASA	72	5.2	3.64	2.816 - 6.892	0.05	0.707
EDU885AR	182	11	9.38	7.206 - 12.171	0.05	0.297
DC4WR	12	3	0.79	0.615 - 1.003	0.07	6.604
PARA	135	7.3	8.16	6.517 - 10.079	0.06	0.097
PAMLA	236	14.2	15.88	13.66 - 18.324	0.07	0.191
NMR8697	477	12.8	13.21	10.161 - 19.421	0.03	0.013
EDU885M	81	4	4.80	3.414 - 6.525	0.06	0.142
EDU1180S	120	10	8.85	5.563 - 13.245	0.07	0.161
EDU184	239	11	11.12	8.092 - 20.083	0.05	0.001
EDU885S	94	4	4.46	3.47 - 5.656	0.05	0.049
PAMLAOD	134	6	8.38	6.361 - 17.284	0.06	0.718
PAMLAOS	140	5.3	5.96	4.362 - 10.143	0.04	0.076
ASATEDU	120	15.7	14.41	11.842 - 17.255	0.12	0.131
ASATNSM	132	20.1	23.80	19.736 - 28.161	0.18	0.702
ASATNMR	50	1	3.44	2.856 - 4.102	0.07	1.863
ASATARE	165	21.3	19.12	16.076 - 22.448	0.12	0.280
Following data sets not included in BVM(3) training data:						
DC8AOW	46	3.1	1.58	0.812 - 3.159	0.03	1.508
DC8AOD	256	3.2	8.74	4.01 - 18.684	0.03	3.637
NMR94EOD	284	17.3	13.39	8.485 - 20.773	0.05	1.202
DC8ASUR	358	10.1	13.22	5.574 - 28.8	0.04	0.762
DCSUREP	69	1	2.17	1.481 - 6.138	0.03	0.649
EDU1351NL	143	2.7	3.67	2.506 - 7.028	0.03	0.263
EDU557NL_A	568	27	35.34	23.562 - 58.539	0.06	2.097
EDU849S	60	15.2	7.27	5.915 - 8.767	0.12	9.853
NMR9209	48	2.5	2.93	2.423 - 3.493	0.06	0.066
EDU1180R	128	2	12.62	9.425 - 16.526	0.10	9.916
EDUAS45	26	8.4	4.69	3.829 - 5.62	0.18	3.581
ASATDC	23	8.1	2.41	1.97 - 2.904	0.10	14.985

Data Set	# Exposures	# DCS Incidents					
		Observed	Predicted	95% CL			
			BVM(3)				Pearson Residual
	(N)	(f)	n	(Low - High)	π		(f-n)^2/n(1-π)
NMR97NOD	103	3.4	3.39	2.919 - 3.918	0.03		0.000
NMRASUR90	64	0	4.09	3.436 - 4.816	0.06		4.367
NMROSUR90	45	1	1.68	1.155 - 2.788	0.04		0.289
SUREX	24	5.3	3.58	3.051 - 4.152	0.15		0.970
UPS290	299	4	5.14	1.819 - 11.7	0.02		0.259
EDU1100	182	17	0.61	0.446 - 0.821	0.00		441.861
SRDRS-OTM	126	3	2.08	1.533 - 2.795	0.02		0.409
SIO2-85	197	4.1	3.36	2.448 - 4.499	0.02		0.168
SIO2-93	38	1	0.57	0.355 - 1.047	0.01		0.340
NOAA	94	1	1.42	0.457 - 24.217	0.02		0.125
MOONVQ	69	3.3	1.22	0.595 - 2.438	0.02		3.591
Totals	6572	344.7	333.13		$\chi^2=$		516.527
					df=42		P=0.0000

Excluding EDU1100:	$\chi^2=$	74.666
	df=41	P=0.0010

APPENDIX F

ESTIMATED DCS RISKS OF DIVES AS ACTUALLY PERFORMED

		NMRI98				BVM(3)				b105L3g			
Dive Date	DVR	Cumulative PDCS, %		Conditional PDCS, %		Cumulative PDCS, %		Conditional PDCS, %		Cumulative PDCS, %		Conditional PDCS, %	
MS Ln #	ID#	Predicted	(Low - High)	Predicted	(Low-High)	Predicted	(Low-High)	Predicted	(Low-High)	Predicted	(Low-High)	Predicted	(Low-High)
020725D01	53	0.247	0.037 - 1.042	0.247	0.037-1.042	0.199	0.084-0.423	0.200	0.082-0.435	1.071	0.921-1.240	1.513	1.262-1.800
		0.780	0.348 - 1.560	0.535	0.159-1.433	0.883	0.534-1.392	0.686	0.325-1.313	2.059	1.644-2.548	0.998	0.661-1.457
020725D02	26	0.189	0.021 - 0.963	0.189	0.021-0.963	0.135	0.047-0.335	0.135	0.047-0.335	1.016	0.864-1.188	1.425	1.172-1.718
		0.745	0.355 - 1.421	0.557	0.203-1.297	0.851	0.519-1.332	0.717	0.376-1.268	2.057	1.618-2.580	1.052	0.689-1.549
020725D03	43	0.262	0.059 - 0.865	0.262	0.059-0.865	0.327	0.171-0.585	0.357	0.167-0.695	1.149	0.994-1.324	1.618	1.357-1.916
		0.851	0.430 - 1.547	0.591	0.214-1.379	1.066	0.672-1.621	0.741	0.325-1.503	2.099	1.698-2.566	0.960	0.649-1.379
020725D04	31	0.226	0.037 - 0.913	0.226	0.037-0.913	0.256	0.121-0.496	0.267	0.115-0.558	1.085	0.927-1.265	1.516	1.239-1.838
		0.853	0.432 - 1.546	0.628	0.243-1.396	1.040	0.658-1.577	0.786	0.384-1.467	2.098	1.656-2.623	1.024	0.668-1.513
020725D06	5	0.298	0.079 - 0.880	0.298	0.079-0.880	0.356	0.200-0.601	0.386	0.196-0.707	1.172	1.011-1.352	1.642	1.373-1.950
		0.994	0.545 - 1.689	0.697	0.288-1.476	1.207	0.798-1.761	0.853	0.411-1.607	2.254	1.825-2.754	1.095	0.759-1.538
020725D07	25	0.225	0.025 - 1.134	0.225	0.025-1.134	0.083	0.023-0.245	0.083	0.023-0.245	0.947	0.770-1.154	1.304	1.031-1.628
		0.552	0.162 - 1.493	0.328	0.038-1.580	0.532	0.279-0.945	0.449	0.196-0.921	1.818	1.409-2.310	0.879	0.532-1.383
020725D08	51	0.193	0.021 - 0.982	0.193	0.021-0.982	0.109	0.036-0.280	0.109	0.036-0.280	0.974	0.824-1.144	1.386	1.135-1.677
		0.712	0.324 - 1.404	0.520	0.173-1.288	0.785	0.475-1.236	0.677	0.361-1.184	1.981	1.552-2.492	1.017	0.661-1.508
020725D09	15	0.217	0.024 - 1.113	0.217	0.024-1.113	0.055	0.012-0.198	0.055	0.012-0.198	0.903	0.735-1.100	1.276	1.012-1.591
		0.754	0.336 - 1.508	0.537	0.168-1.392	0.755	0.467-1.168	0.700	0.409-1.138	2.031	1.597-2.547	1.138	0.768-1.634
020730D01	52	0.241	0.038 - 0.982	0.241	0.038-0.982	0.203	0.087-0.428	0.203	0.085-0.435	1.092	0.940-1.261	1.535	1.277-1.831
		0.790	0.383 - 1.484	0.551	0.191-1.330	0.921	0.564-1.435	0.719	0.350-1.350	2.075	1.660-2.562	0.994	0.664-1.441
020730D02	3	0.235	0.035 - 0.994	0.235	0.035-0.994	0.191	0.079-0.411	0.191	0.079-0.411	1.074	0.924-1.243	1.504	1.247-1.799
		0.746	0.347 - 1.448	0.512	0.163-1.311	0.868	0.522-1.374	0.679	0.322-1.298	2.033	1.599-2.549	0.969	0.619-1.458
020730D03	6	0.241	0.042 - 0.932	0.241	0.042-0.932	0.247	0.115-0.485	0.254	0.109-0.532	1.111	0.957-1.283	1.556	1.294-1.856
		0.717	0.326 - 1.415	0.477	0.141-1.286	0.883	0.527-1.406	0.637	0.270-1.327	1.995	1.586-2.478	0.895	0.572-1.346
020730D04	23	0.236	0.035 - 1.006	0.236	0.035-1.006	0.178	0.072-0.395	0.178	0.072-0.395	1.067	0.918-1.235	1.494	1.242-1.783
		0.721	0.322 - 1.444	0.486	0.143-1.318	0.827	0.490-1.325	0.650	0.304-1.257	2.002	1.577-2.506	0.945	0.602-1.424
020730D06	57	0.240	0.039 - 0.976	0.240	0.039-0.976	0.205	0.088-0.431	0.207	0.085-0.451	1.102	0.950-1.273	1.559	1.299-1.857
		0.788	0.375 - 1.501	0.549	0.184-1.354	0.916	0.559-1.430	0.712	0.343-1.346	2.084	1.649-2.598	0.992	0.644-1.474

		NMRI98				BVM(3)				b105L3g			
		Cumulative PDCS, %		Conditional PDCS, %		Cumulative PDCS, %		Conditional PDCS, %		Cumulative PDCS, %		Conditional PDCS, %	
Dive Date MS Ln #	DVR ID#	Predicted	(Low - High)	Predicted	(Low-High)	Predicted	(Low-High)	Predicted	(Low-High)	Predicted	(Low-High)	Predicted	(Low-High)
020730D07	40	0.878	0.535 - 1.375	0.970	0.520-1.680	0.674	0.505-0.885	0.917	0.629-1.299	1.744	1.517-1.996	2.699	2.330-3.108
		1.641	1.143 - 2.287	0.770	0.352-1.511	1.585	1.163-2.113	0.917	0.403-1.844	2.873	2.417-3.388	1.149	0.818-1.575
020730D08	21	0.218	0.030 - 0.976	0.218	0.030-0.976	0.159	0.060-0.369	0.159	0.060-0.369	1.059	0.908-1.227	1.491	1.239-1.780
		0.671	0.291 - 1.373	0.453	0.129-1.259	0.770	0.447-1.256	0.612	0.282-1.198	1.978	1.559-2.475	0.929	0.590-1.405
020730D09	13	0.237	0.032 - 1.063	0.237	0.032-1.063	0.120	0.039-0.315	0.120	0.039-0.315	1.019	0.866-1.193	1.429	1.181-1.716
		0.569	0.187 - 1.422	0.333	0.046-1.443	0.585	0.307-1.036	0.465	0.188-1.009	1.829	1.435-2.299	0.818	0.495-1.289
020801D01	30	1.223	1.013 - 1.466	1.704	1.377-2.086	1.006	0.816-1.229	1.533	1.184-1.955	1.114	0.578-1.976	1.643	0.963-2.637
		5.812	4.892 - 6.838	4.645	3.851-5.544	4.612	3.840-5.482	3.642	2.791-4.660	4.738	3.499-6.242	3.665	2.471-5.212
020801D02	56	1.112	0.910 - 1.348	1.493	1.192-1.849	0.918	0.735-1.135	1.349	1.018-1.758	1.031	0.482-1.978	1.514	0.827-2.569
		4.059	3.392 - 4.811	2.980	2.399-3.655	3.174	2.583-3.854	2.277	1.544-3.239	3.824	2.659-5.304	2.823	1.708-4.384
020801D03	19	1.025	0.770 - 1.341	1.332	1.008-1.730	0.845	0.667-1.060	1.205	0.888-1.603	1.011	0.425-2.095	1.493	0.775-2.632
		3.884	3.225 - 4.629	2.888	2.301-3.576	3.033	2.455-3.703	2.206	1.499-3.134	3.640	2.498-5.104	2.655	1.567-4.209
020801D04	35	1.297	1.055 - 1.578	1.841	1.483-2.260	1.062	0.866-1.290	1.650	1.290-2.081	1.203	0.654-2.056	1.804	1.102-2.798
		4.268	3.566 - 5.058	3.010	2.415-3.703	3.334	2.733-4.023	2.297	1.518-3.336	3.994	2.814-5.479	2.825	1.703-4.400
020801D06	10	1.302	1.076 - 1.563	1.893	1.535-2.311	1.085	0.877-1.329	1.714	1.333-2.172	1.173	0.646-1.984	1.744	1.076-2.685
		4.874	4.099 - 5.743	3.619	2.974-4.357	3.848	3.178-4.611	2.794	1.963-3.852	4.361	3.168-5.829	3.226	2.082-4.757
020801D07	55	1.338	1.105 - 1.608	1.937	1.575-2.359	1.101	0.891-1.348	1.737	1.353-2.197	1.216	0.645-2.117	1.809	1.104-2.808
		4.788	4.023 - 5.645	3.496	2.857-4.229	3.771	3.109-4.525	2.700	1.867-3.773	4.247	3.141-5.594	3.069	2.008-4.479
020801D08	28	1.241	0.980 - 1.552	1.754	1.389-2.187	1.021	0.830-1.246	1.581	1.226-2.009	1.190	0.603-2.146	1.797	1.077-2.830
		4.252	3.540 - 5.056	3.049	2.438-3.763	3.333	2.730-4.024	2.335	1.567-3.350	3.968	2.814-5.413	2.811	1.713-4.344
020801D09	14	1.505	1.250 - 1.799	2.247	1.845-2.711	1.225	0.999-1.489	1.990	1.579-2.476	1.394	0.832-2.211	2.075	1.358-3.040
		4.439	3.726 - 5.240	2.979	2.391-3.663	3.459	2.835-4.172	2.261	1.413-3.435	4.134	2.993-5.543	2.779	1.696-4.288
020806D01	25	0.417	0.132 - 1.080	0.530	0.207-1.174	0.259	0.183-0.360	0.562	0.341-0.887	0.804	0.471-1.301	2.043	1.373-2.932
		1.784	1.122 - 2.703	1.373	0.744-2.345	1.519	1.139-1.989	1.263	0.854-1.809	2.865	2.127-3.771	2.078	1.378-3.012
020806D02	49	0.417	0.121 - 1.144	0.517	0.186-1.218	0.250	0.174-0.351	0.533	0.317-0.855	0.782	0.462-1.256	1.960	1.309-2.826
		1.598	0.948 - 2.541	1.186	0.580-2.197	1.354	0.991-1.811	1.107	0.715-1.647	2.740	2.004-3.653	1.973	1.275-2.923
020806D03	39	0.413	0.128 - 1.084	0.522	0.200-1.174	0.256	0.180-0.357	0.552	0.332-0.876	0.795	0.472-1.273	2.002	1.347-2.870
		1.797	1.160 - 2.666	1.389	0.782-2.304	1.550	1.166-2.023	1.298	0.886-1.843	2.935	2.205-3.825	2.157	1.463-3.070
020806D04	47	0.599	0.278 - 1.168	0.974	0.577-1.559	0.387	0.305-0.487	1.020	0.732-1.389	0.988	0.728-1.317	2.424	1.884-3.069
		2.410	1.701 - 3.314	1.821	1.143-2.764	2.003	1.583-2.500	1.622	1.157-2.217	3.273	2.532-4.157	2.308	1.606-3.213
020806D06	2	0.384	0.115 - 1.036	0.478	0.175-1.114	0.237	0.162-0.340	0.512	0.298-0.834	0.784	0.446-1.300	2.005	1.321-2.924
		1.470	0.830 - 2.433	1.090	0.497-2.130	1.246	0.895-1.696	1.011	0.633-1.547	2.766	2.001-3.722	1.998	1.271-2.996

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020806D07	50	1.470	0.830 - 2.433	1.470	0.830-2.433	0.466	0.276-0.752	0.466	0.276-0.752	2.766	2.001-3.722	2.766	2.001-3.722
020806D08	44	0.482	0.195 - 1.044	0.726	0.378-1.293	0.322	0.244-0.420	0.799	0.538-1.151	0.885	0.587-1.291	2.225	1.628-2.970
		2.127	1.496 - 2.936	1.653	1.044-2.498	1.848	1.439-2.338	1.531	1.086-2.102	3.140	2.402-4.026	2.275	1.577-3.177
020806D09	37	0.414	0.124 - 1.108	0.511	0.188-1.184	0.249	0.173-0.350	0.528	0.314-0.849	0.798	0.457-1.316	2.015	1.329-2.935
		1.671	1.027 - 2.581	1.262	0.657-2.228	1.421	1.051-1.884	1.175	0.776-1.716	2.840	2.092-3.764	2.058	1.348-3.015
020808D01	3	1.142	0.917 - 1.407	1.578	1.255-1.961	0.928	0.747-1.142	1.416	1.078-1.829	1.044	0.495-1.985	1.562	0.868-2.613
		3.926	3.272 - 4.666	2.816	2.244-3.488	3.056	2.483-3.719	2.148	1.423-3.116	3.624	2.509-5.046	2.607	1.545-4.119
020808D02	6	1.057	0.837 - 1.319	1.420	1.114-1.787	0.862	0.686-1.072	1.280	0.955-1.683	0.991	0.429-2.013	1.479	0.776-2.586
		3.543	2.927 - 4.244	2.513	1.962-3.168	2.749	2.206-3.381	1.903	1.216-2.846	3.457	2.350-4.886	2.490	1.438-4.017
020808D03	40	1.144	0.924 - 1.404	1.582	1.261-1.962	0.935	0.754-1.149	1.424	1.087-1.837	1.046	0.506-1.955	1.562	0.877-2.592
		3.829	3.190 - 4.551	2.716	2.159-3.369	2.987	2.423-3.640	2.072	1.350-3.046	3.607	2.493-5.030	2.588	1.528-4.102
020808D04	21	1.229	1.005 - 1.490	1.755	1.415-2.153	1.000	0.813-1.219	1.572	1.220-1.998	1.119	0.583-1.978	1.685	0.999-2.679
		3.673	3.052 - 4.378	2.474	1.935-3.115	2.845	2.301-3.476	1.864	1.139-2.890	3.530	2.423-4.950	2.438	1.392-3.968
020808D06	13	1.429	1.184 - 1.712	2.232	1.827-2.699	1.165	0.952-1.413	1.991	1.584-2.472	1.327	0.785-2.119	2.071	1.364-3.020
		4.119	3.450 - 4.872	2.728	2.172-3.381	3.208	2.618-3.886	2.067	1.257-3.211	3.820	2.712-5.209	2.527	1.480-4.030
020808D07	52	1.160	0.940 - 1.417	1.636	1.308-2.022	0.950	0.767-1.165	1.476	1.131-1.896	1.070	0.530-1.968	1.623	0.936-2.637
		3.905	3.255 - 4.640	2.777	2.212-3.440	3.048	2.477-3.707	2.118	1.388-3.099	3.707	2.576-5.145	2.665	1.588-4.193
020808D08	22	1.187	0.963 - 1.449	1.683	1.350-2.076	0.968	0.784-1.185	1.514	1.166-1.936	1.107	0.555-2.014	1.689	0.989-2.712
		3.801	3.160 - 4.527	2.645	2.086-3.306	2.949	2.391-3.594	2.000	1.274-2.997	3.613	2.499-5.034	2.534	1.477-4.056
020808D09	53	1.223	1.001 - 1.480	1.761	1.420-2.160	1.000	0.812-1.219	1.585	1.230-2.013	1.130	0.591-1.991	1.731	1.039-2.724
		3.756	3.128 - 4.466	2.564	2.022-3.205	2.912	2.360-3.550	1.931	1.201-2.952	3.537	2.439-4.941	2.434	1.397-3.947
020813D01	43	0.399	0.222 - 0.676	0.399	0.222-0.676	0.589	0.356-0.931	0.589	0.356-0.931	0.640	0.328-1.153	0.648	0.320-1.203
		2.026	1.542 - 2.615	1.634	1.174-2.220	2.085	1.531-2.776	1.505	0.868-2.448	2.039	1.360-2.945	1.409	0.777-2.376
020813D02	19	0.404	0.227 - 0.680	0.404	0.227-0.680	0.596	0.362-0.939	0.596	0.363-0.939	0.637	0.329-1.143	0.645	0.321-1.193
		1.882	1.411 - 2.462	1.484	1.036-2.066	1.961	1.418-2.646	1.373	0.748-2.337	1.937	1.269-2.839	1.308	0.690-2.284
020813D03	10	0.464	0.275 - 0.748	0.464	0.275-0.748	0.664	0.416-1.018	0.668	0.412-1.038	0.688	0.373-1.185	0.698	0.364-1.241
		1.985	1.501 - 2.577	1.527	1.071-2.119	2.063	1.504-2.762	1.408	0.756-2.424	1.978	1.306-2.877	1.299	0.682-2.275
020813D04	56	0.407	0.230 - 0.683	0.407	0.230-0.683	0.594	0.361-0.936	0.594	0.361-0.935	0.636	0.325-1.152	0.644	0.317-1.200
		1.782	1.328 - 2.344	1.381	0.949-1.950	1.869	1.335-2.549	1.282	0.670-2.257	1.804	1.163-2.678	1.175	0.589-2.135
020813D06	8	0.396	0.221 - 0.671	0.396	0.221-0.671	0.583	0.353-0.922	0.583	0.353-0.921	0.618	0.315-1.118	0.625	0.307-1.165
		1.842	1.380 - 2.412	1.452	1.012-2.025	1.921	1.384-2.600	1.345	0.729-2.300	1.861	1.209-2.745	1.251	0.650-2.210

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020813D07	27	0.352	0.190 - 0.614	0.352	0.190-0.614	0.532	0.313-0.862	0.532	0.313-0.862	0.516	0.243-0.999	0.518	0.238-1.020
		1.794	1.350 - 2.341	1.447	1.022-1.996	1.866	1.339-2.535	1.341	0.744-2.253	1.712	1.093-2.566	1.202	0.627-2.122
020813D08	35	0.367	0.199 - 0.637	0.367	0.199-0.637	0.552	0.327-0.887	0.552	0.327-0.887	0.581	0.285-1.086	0.585	0.277-1.124
		1.912	1.446 - 2.483	1.550	1.105-2.121	1.976	1.436-2.654	1.432	0.817-2.352	1.903	1.243-2.796	1.330	0.716-2.287
020813D09	9	0.310	0.154 - 0.581	0.310	0.154-0.581	0.490	0.276-0.823	0.490	0.276-0.823	0.520	0.236-1.034	0.523	0.229-1.066
		1.585	1.158 - 2.122	1.278	0.867-1.827	1.676	1.168-2.337	1.192	0.624-2.096	1.616	1.003-2.479	1.102	0.538-2.047
020815D01	29	0.457	0.140 - 1.205	0.574	0.220-1.292	0.264	0.188-0.364	0.574	0.351-0.899	0.832	0.482-1.358	2.102	1.403-3.031
		1.753	1.087 - 2.688	1.303	0.680-2.293	1.471	1.093-1.943	1.211	0.801-1.766	2.905	2.163-3.815	2.090	1.385-3.032
020815D02	51	0.404	0.079 - 1.426	0.443	0.099-1.430	0.196	0.122-0.305	0.376	0.194-0.679	0.765	0.377-1.419	1.971	1.174-3.116
		1.495	0.781 - 2.622	1.095	0.445-2.319	1.209	0.861-1.657	1.015	0.646-1.531	2.783	2.017-3.739	2.033	1.305-3.028
020815D03	47	0.412	0.101 - 1.257	0.482	0.144-1.293	0.228	0.153-0.331	0.464	0.262-0.777	0.795	0.427-1.377	2.027	1.284-3.050
		1.536	0.863 - 2.548	1.128	0.510-2.216	1.275	0.916-1.734	1.050	0.666-1.589	2.748	1.999-3.682	1.969	1.259-2.943
020815D04	42	0.460	0.142 - 1.203	0.587	0.229-1.299	0.268	0.192-0.368	0.591	0.365-0.920	0.838	0.492-1.351	2.109	1.420-3.018
		1.522	0.827 - 2.592	1.067	0.439-2.243	1.239	0.888-1.688	0.974	0.591-1.528	2.720	1.945-3.697	1.898	1.165-2.931
020815D06	24	0.425	0.125 - 1.159	0.525	0.190-1.231	0.245	0.169-0.347	0.529	0.313-0.852	0.824	0.456-1.397	2.120	1.381-3.117
		1.766	1.110 - 2.678	1.346	0.728-2.305	1.494	1.112-1.969	1.253	0.843-1.800	3.025	2.269-3.946	2.219	1.500-3.165
020815D07	26	0.430	0.123 - 1.188	0.535	0.192-1.260	0.245	0.170-0.347	0.537	0.319-0.862	0.816	0.462-1.359	2.085	1.372-3.040
		1.466	0.785 - 2.526	1.041	0.425-2.201	1.197	0.848-1.648	0.954	0.578-1.502	2.708	1.935-3.682	1.907	1.176-2.935
020815D08	32	0.412	0.110 - 1.191	0.517	0.178-1.256	0.232	0.157-0.335	0.523	0.305-0.852	0.801	0.451-1.336	2.055	1.353-2.997
		1.771	1.105 - 2.703	1.365	0.736-2.343	1.497	1.112-1.976	1.268	0.858-1.814	3.005	2.248-3.929	2.222	1.501-3.171
020815D09	25	0.496	0.151 - 1.309	0.688	0.287-1.447	0.288	0.211-0.387	0.699	0.451-1.044	0.847	0.540-1.279	2.120	1.502-2.909
		1.840	1.119 - 2.865	1.351	0.678-2.449	1.521	1.140-1.992	1.237	0.821-1.799	2.878	2.126-3.803	2.048	1.335-3.010
020820D01	4	0.154	0.035 - 0.517	0.154	0.035-0.517	0.262	0.126-0.504	0.262	0.126-0.504	1.211	1.016-1.434	1.314	1.075-1.592
		0.604	0.331 - 1.036	0.451	0.196-0.929	0.895	0.534-1.424	0.634	0.262-1.344	1.952	1.547-2.431	0.750	0.461-1.169
020820D02	57	0.136	0.026 - 0.517	0.136	0.026-0.517	0.222	0.099-0.453	0.222	0.099-0.453	1.183	1.002-1.389	1.287	1.062-1.546
		0.560	0.300 - 0.978	0.425	0.182-0.883	0.828	0.484-1.341	0.607	0.255-1.273	1.914	1.528-2.369	0.740	0.464-1.133
020820D03	5	0.120	0.019 - 0.507	0.120	0.019-0.507	0.205	0.088-0.431	0.205	0.088-0.431	1.139	0.943-1.365	1.230	0.988-1.516
		0.531	0.277 - 0.948	0.412	0.173-0.869	0.795	0.460-1.300	0.591	0.249-1.239	1.869	1.457-2.362	0.738	0.434-1.192
020820D04	40	0.112	0.015 - 0.524	0.112	0.015-0.524	0.180	0.073-0.398	0.180	0.073-0.398	1.111	0.927-1.322	1.199	0.971-1.466
		0.511	0.262 - 0.923	0.399	0.166-0.849	0.757	0.433-1.251	0.578	0.248-1.195	1.821	1.417-2.306	0.718	0.420-1.165
020820D06	21	0.101	0.010 - 0.559	0.101	0.010-0.559	0.130	0.044-0.328	0.130	0.044-0.328	1.056	0.889-1.246	1.139	0.932-1.379
		0.435	0.205 - 0.842	0.334	0.123-0.783	0.636	0.345-1.097	0.506	0.214-1.061	1.703	1.324-2.159	0.654	0.374-1.082

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020820D07	13	0.102	0.013 - 0.506	0.102	0.013-0.506	0.164	0.063-0.376	0.164	0.063-0.376	1.098	0.917-1.305	1.186	0.962-1.450
		0.573	0.321 - 0.964	0.471	0.229-0.889	0.823	0.489-1.317	0.660	0.317-1.251	1.913	1.488-2.422	0.824	0.502-1.291
020820D08	11	0.108	0.014 - 0.521	0.108	0.014-0.521	0.169	0.066-0.383	0.169	0.066-0.383	1.092	0.909-1.303	1.179	0.952-1.446
		0.479	0.239 - 0.885	0.372	0.149-0.817	0.716	0.401-1.202	0.548	0.229-1.154	1.763	1.365-2.242	0.678	0.385-1.126
020820D09	52	0.103	0.010 - 0.598	0.103	0.010-0.598	0.116	0.037-0.309	0.116	0.037-0.309	1.032	0.868-1.218	1.110	0.908-1.345
		0.440	0.204 - 0.862	0.337	0.121-0.805	0.624	0.339-1.078	0.509	0.222-1.043	1.709	1.334-2.159	0.685	0.404-1.104
020822D01	37	0.569	0.371 - 0.845	0.569	0.371-0.845	0.731	0.492-1.055	0.731	0.492-1.055	0.719	0.414-1.181	0.722	0.407-1.207
		2.035	1.547 - 2.629	1.474	1.022-2.064	2.090	1.544-2.767	1.369	0.715-2.405	1.992	1.327-2.878	1.281	0.673-2.247
020822D02	29	0.429	0.258 - 0.683	0.429	0.258-0.683	0.576	0.364-0.879	0.576	0.364-0.879	0.588	0.291-1.091	0.588	0.289-1.097
		1.605	1.178 - 2.140	1.181	0.776-1.732	1.681	1.186-2.319	1.111	0.544-2.059	1.629	1.016-2.487	1.047	0.491-2.004
020822D03	28	0.475	0.287 - 0.754	0.475	0.287-0.754	0.626	0.404-0.936	0.626	0.404-0.936	0.701	0.370-1.235	0.705	0.363-1.268
		1.700	1.255 - 2.254	1.230	0.812-1.799	1.777	1.268-2.425	1.158	0.568-2.141	1.762	1.130-2.630	1.069	0.501-2.046
020822D04	35	0.453	0.272 - 0.722	0.453	0.272-0.722	0.603	0.385-0.910	0.603	0.385-0.910	0.629	0.323-1.133	0.630	0.319-1.148
		1.861	1.400 - 2.427	1.415	0.980-1.984	1.917	1.396-2.572	1.322	0.717-2.262	1.862	1.215-2.737	1.241	0.645-2.192
020822D06	54	0.573	0.373 - 0.853	0.573	0.373-0.853	0.736	0.496-1.060	0.736	0.497-1.060	0.755	0.439-1.230	0.761	0.430-1.268
		2.054	1.567 - 2.644	1.489	1.039-2.074	2.106	1.559-2.785	1.380	0.724-2.419	2.005	1.344-2.883	1.260	0.657-2.221
020822D07	39	0.742	0.519 - 1.034	0.742	0.519-1.034	0.907	0.643-1.250	0.923	0.637-1.302	0.904	0.580-1.356	0.914	0.568-1.407
		2.026	1.540 - 2.619	1.294	0.854-1.891	2.097	1.545-2.783	1.201	0.521-2.425	1.982	1.342-2.825	1.088	0.521-2.048
020822D08	10	0.497	0.309 - 0.770	0.497	0.309-0.770	0.652	0.426-0.965	0.652	0.426-0.965	0.675	0.365-1.168	0.678	0.358-1.195
		1.845	1.383 - 2.413	1.354	0.921-1.929	1.907	1.383-2.565	1.263	0.649-2.251	1.853	1.210-2.724	1.186	0.598-2.146
020822D09	56	0.397	0.221 - 0.673	0.397	0.221-0.673	0.537	0.332-0.835	0.537	0.332-0.835	0.584	0.274-1.130	0.585	0.271-1.144
		1.503	1.074 - 2.051	1.110	0.703-1.682	1.581	1.099-2.208	1.049	0.504-1.972	1.597	0.979-2.474	1.018	0.460-2.006
020827D01	46	0.123	0.018 - 0.541	0.123	0.018-0.541	0.221	0.091-0.478	0.221	0.091-0.478	1.192	1.000-1.411	1.277	1.043-1.549
		0.522	0.263 - 0.959	0.400	0.159-0.881	0.798	0.452-1.328	0.579	0.228-1.273	1.896	1.488-2.383	0.713	0.418-1.155
020827D02	31	0.106	0.014 - 0.515	0.106	0.014-0.515	0.196	0.076-0.444	0.196	0.076-0.444	1.150	0.956-1.373	1.226	0.990-1.502
		0.523	0.275 - 0.928	0.417	0.183-0.854	0.795	0.453-1.316	0.601	0.253-1.258	1.868	1.451-2.370	0.727	0.421-1.189
020827D03	42	0.108	0.011 - 0.600	0.108	0.011-0.600	0.159	0.056-0.392	0.159	0.056-0.392	1.095	0.913-1.303	1.159	0.941-1.415
		0.447	0.202 - 0.895	0.339	0.115-0.839	0.668	0.359-1.160	0.510	0.201-1.125	1.762	1.377-2.223	0.675	0.392-1.102
020827D04	15	0.118	0.018 - 0.507	0.118	0.018-0.507	0.230	0.097-0.490	0.230	0.097-0.490	1.187	0.987-1.417	1.269	1.027-1.553
		0.506	0.253 - 0.934	0.389	0.154-0.860	0.793	0.447-1.325	0.564	0.215-1.273	1.864	1.459-2.346	0.685	0.395-1.124
020827D06	5	0.136	0.029 - 0.472	0.136	0.029-0.472	0.297	0.141-0.575	0.297	0.141-0.575	1.264	1.057-1.500	1.360	1.111-1.649
		0.633	0.354 - 1.067	0.498	0.233-0.967	0.981	0.592-1.545	0.685	0.282-1.454	2.033	1.605-2.541	0.779	0.473-1.224

Dive Date MS Ln #	DVR ID#	NMRI98 Cumulative PDCS, % Predicted	(Low - High)	Conditional PDCS, % Predicted	(Low-High)	BVM(3) Cumulative PDCS, % Predicted	(Low-High)	Conditional PDCS, % Predicted	(Low-High)	b105L3g Cumulative PDCS, % Predicted	(Low-High)	Conditional PDCS, % Predicted	(Low-High)
020827D07	2	0.129	0.025 - 0.483	0.129	0.025-0.483	0.270	0.123-0.542	0.270	0.123-0.542	1.237	1.023-1.485	1.328	1.067-1.636
		0.462	0.213 - 0.907	0.333	0.110-0.841	0.766	0.421-1.305	0.497	0.157-1.281	1.851	1.458-2.319	0.622	0.348-1.048
020827D08	48	0.139	0.032 - 0.469	0.139	0.032-0.469	0.309	0.149-0.590	0.309	0.149-0.590	1.288	1.083-1.521	1.390	1.142-1.677
		0.548	0.285 - 0.981	0.409	0.166-0.889	0.893	0.519-1.454	0.586	0.207-1.394	1.968	1.568-2.440	0.690	0.413-1.097
020827D09	53	0.135	0.029 - 0.474	0.135	0.029-0.474	0.294	0.139-0.573	0.294	0.139-0.573	1.263	1.037-1.526	1.360	1.084-1.688
		0.584	0.314 - 1.017	0.450	0.196-0.924	0.925	0.546-1.485	0.632	0.244-1.410	1.994	1.550-2.525	0.739	0.420-1.229
020829D02	38	0.488	0.251 - 0.881	0.759	0.461-1.194	0.396	0.304-0.510	0.834	0.571-1.186	0.744	0.399-1.293	1.739	1.090-2.644
		2.574	1.995 - 3.268	2.097	1.536-2.796	2.175	1.728-2.702	1.786	1.295-2.404	3.222	2.290-4.394	2.496	1.603-3.706
020829D03	17	0.393	0.165 - 0.834	0.539	0.268-0.996	0.320	0.231-0.436	0.607	0.378-0.936	0.649	0.303-1.257	1.515	0.857-2.502
		2.057	1.493 - 2.766	1.671	1.123-2.399	1.750	1.339-2.248	1.434	0.986-2.023	2.898	1.987-4.076	2.264	1.390-3.488
020829D04	7	0.465	0.206 - 0.943	0.682	0.371-1.173	0.365	0.274-0.479	0.739	0.489-1.082	0.709	0.356-1.298	1.666	0.999-2.624
		2.856	2.153 - 3.710	2.402	1.715-3.272	2.357	1.889-2.904	1.999	1.500-2.613	3.449	2.514-4.604	2.759	1.857-3.942
020829D06	23	0.367	0.122 - 0.920	0.498	0.212-1.040	0.288	0.199-0.407	0.556	0.333-0.888	0.637	0.274-1.313	1.558	0.861-2.618
		2.055	1.460 - 2.812	1.694	1.114-2.476	1.736	1.324-2.237	1.452	1.009-2.031	2.877	1.962-4.066	2.255	1.377-3.488
020829D07	3	0.422	0.191 - 0.845	0.621	0.338-1.068	0.346	0.256-0.461	0.698	0.453-1.040	0.679	0.336-1.255	1.587	0.938-2.530
		2.027	1.455 - 2.751	1.612	1.058-2.360	1.714	1.310-2.206	1.373	0.925-1.970	2.798	1.901-3.965	2.134	1.277-3.357
020829D08	22	0.428	0.180 - 0.904	0.618	0.321-1.105	0.340	0.250-0.455	0.683	0.440-1.023	0.686	0.330-1.297	1.636	0.963-2.617
		2.110	1.510 - 2.870	1.689	1.108-2.476	1.777	1.366-2.276	1.443	0.990-2.038	2.937	2.031-4.103	2.267	1.398-3.481
020829D09	24	0.465	0.225 - 0.881	0.739	0.436-1.189	0.378	0.286-0.492	0.819	0.555-1.175	0.722	0.378-1.279	1.723	1.071-2.637
		2.395	1.810 - 3.107	1.939	1.372-2.666	2.025	1.592-2.541	1.653	1.177-2.264	3.084	2.187-4.217	2.379	1.517-3.553
020904D01	16	0.279	0.141 - 0.514	0.279	0.141-0.514	0.499	0.301-0.790	0.499	0.301-0.790	0.754	0.518-1.069	0.754	0.518-1.069
		1.214	0.834 - 1.717	0.938	0.580-1.451	1.517	1.045-2.136	1.023	0.495-1.916	1.595	1.092-2.257	0.847	0.422-1.556
020904D02	39	0.311	0.165 - 0.550	0.311	0.165-0.550	0.539	0.334-0.837	0.539	0.334-0.837	0.775	0.531-1.100	0.775	0.531-1.100
		1.200	0.821 - 1.703	0.892	0.539-1.408	1.513	1.039-2.136	0.978	0.445-1.917	1.553	1.072-2.182	0.784	0.384-1.461
020904D03	49	0.283	0.144 - 0.517	0.283	0.144-0.517	0.504	0.305-0.796	0.504	0.305-0.796	0.754	0.515-1.073	0.754	0.515-1.073
		1.128	0.762 - 1.618	0.848	0.504-1.353	1.436	0.973-2.049	0.936	0.422-1.850	1.506	1.021-2.149	0.757	0.355-1.459
020904D04	14	0.300	0.157 - 0.537	0.300	0.157-0.537	0.527	0.324-0.823	0.527	0.324-0.823	0.774	0.530-1.100	0.774	0.530-1.100
		1.200	0.821 - 1.703	0.902	0.548-1.417	1.510	1.037-2.131	0.988	0.457-1.913	1.582	1.087-2.233	0.814	0.399-1.515
020904D06	34	0.233	0.108 - 0.461	0.233	0.108-0.461	0.442	0.257-0.723	0.442	0.257-0.723	0.715	0.492-1.011	0.715	0.492-1.011
		1.016	0.670 - 1.487	0.784	0.457-1.274	1.312	0.870-1.909	0.874	0.391-1.738	1.423	0.967-2.030	0.714	0.334-1.380
020904D07	8	0.295	0.153 - 0.532	0.295	0.153-0.532	0.524	0.321-0.819	0.524	0.321-0.819	0.771	0.540-1.074	0.771	0.540-1.074
		1.100	0.737 - 1.588	0.807	0.469-1.314	1.412	0.952-2.026	0.894	0.382-1.835	1.479	1.025-2.073	0.714	0.340-1.362

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020904D08	56	0.205	0.090 - 0.423	0.205	0.090-0.423	0.405	0.229-0.680	0.405	0.229-0.680	0.647	0.431-0.942	0.647	0.431-0.942
		0.905	0.582 - 1.356	0.702	0.396-1.173	1.197	0.774-1.781	0.795	0.340-1.638	1.283	0.849-1.870	0.640	0.281-1.297
020904D09	5	0.234	0.110 - 0.457	0.234	0.110-0.457	0.443	0.257-0.724	0.443	0.257-0.724	0.680	0.455-0.987	0.680	0.455-0.987
		0.904	0.578 - 1.361	0.672	0.366-1.154	1.202	0.776-1.790	0.763	0.305-1.653	1.276	0.844-1.860	0.599	0.250-1.265
020906D01	27	0.246	0.095 - 0.561	0.246	0.095-0.561	0.428	0.249-0.701	0.442	0.242-0.762	0.984	0.804-1.195	1.214	0.931-1.559
		1.918	1.398 - 2.571	1.676	1.166-2.340	2.105	1.589-2.736	1.684	1.115-2.450	2.814	2.212-3.527	1.848	1.311-2.537
020906D02	43	0.203	0.065 - 0.531	0.203	0.065-0.531	0.379	0.209-0.649	0.387	0.203-0.692	0.953	0.773-1.165	1.178	0.898-1.522
		1.827	1.321 - 2.464	1.627	1.129-2.276	2.015	1.510-2.636	1.642	1.090-2.382	2.747	2.148-3.458	1.811	1.275-2.502
020906D03	35	0.160	0.032 - 0.574	0.160	0.032-0.574	0.299	0.151-0.551	0.299	0.151-0.551	0.904	0.712-1.134	1.112	0.830-1.464
		1.714	1.223 - 2.341	1.557	1.068-2.199	1.879	1.397-2.475	1.584	1.069-2.269	2.678	2.088-3.380	1.790	1.259-2.475
020906D04	51	0.195	0.060 - 0.523	0.195	0.060-0.523	0.359	0.195-0.625	0.364	0.189-0.656	0.950	0.766-1.167	1.177	0.896-1.522
		1.631	1.145 - 2.257	1.439	0.960-2.082	1.816	1.331-2.423	1.462	0.933-2.194	2.619	2.049-3.297	1.686	1.173-2.352
020906D07	2	0.156	0.026 - 0.638	0.156	0.026-0.638	0.283	0.140-0.531	0.283	0.140-0.531	0.918	0.715-1.163	1.146	0.851-1.515
		1.650	1.156 - 2.291	1.496	1.004-2.155	1.805	1.332-2.393	1.526	1.022-2.200	2.665	2.084-3.355	1.763	1.240-2.438
020906D08	1	0.790	0.500 - 1.199	0.868	0.533-1.350	0.862	0.669-1.097	1.103	0.798-1.492	1.468	1.259-1.701	1.921	1.581-2.313
		2.690	2.027 - 3.497	1.915	1.294-2.734	2.709	2.165-3.345	1.862	1.177-2.810	3.313	2.734-3.974	1.873	1.387-2.476
020906D09	42	0.186	0.053 - 0.529	0.186	0.053-0.529	0.342	0.182-0.604	0.346	0.177-0.631	0.925	0.742-1.142	1.147	0.869-1.489
		1.611	1.130 - 2.235	1.428	0.951-2.068	1.790	1.309-2.392	1.453	0.931-2.173	2.588	2.022-3.261	1.678	1.167-2.342
020910D01	6	1.611	1.130 - 2.235	1.611	1.130-2.235	0.460	0.271-0.745	0.460	0.271-0.745	2.588	2.022-3.261	2.588	2.022-3.261
020910D02	33	0.161	0.037 - 0.532	0.161	0.037-0.532	0.311	0.160-0.566	0.314	0.155-0.590	0.923	0.740-1.141	1.152	0.871-1.499
		1.318	0.877 - 1.913	1.159	0.723-1.775	1.536	1.084-2.118	1.229	0.741-1.934	2.356	1.803-3.023	1.446	0.952-2.115
020910D03	3	0.174	0.048 - 0.509	0.174	0.048-0.509	0.329	0.173-0.588	0.335	0.167-0.624	0.935	0.752-1.152	1.167	0.886-1.513
		1.328	0.885 - 1.924	1.155	0.719-1.773	1.547	1.092-2.134	1.222	0.728-1.942	2.350	1.802-3.010	1.428	0.939-2.092
020910D04	36	0.186	0.053 - 0.535	0.186	0.053-0.535	0.353	0.190-0.617	0.363	0.183-0.669	0.951	0.770-1.164	1.189	0.907-1.534
		1.489	1.030 - 2.089	1.305	0.853-1.923	1.712	1.237-2.312	1.364	0.847-2.096	2.466	1.898-3.150	1.530	1.023-2.207
020910D06	38	0.183	0.049 - 0.548	0.183	0.049-0.548	0.343	0.183-0.604	0.357	0.176-0.672	0.935	0.750-1.155	1.186	0.898-1.540
		1.519	1.055 - 2.124	1.338	0.879-1.961	1.730	1.255-2.329	1.392	0.876-2.115	2.494	1.915-3.190	1.573	1.055-2.264
020910D07	45	0.170	0.043 - 0.532	0.170	0.043-0.532	0.322	0.168-0.579	0.333	0.161-0.633	0.910	0.725-1.129	1.147	0.863-1.499
		1.435	0.983 - 2.030	1.266	0.820-1.880	1.644	1.180-2.234	1.326	0.824-2.036	2.411	1.844-3.095	1.515	1.007-2.199
020910D08	13	0.192	0.059 - 0.516	0.192	0.059-0.516	0.354	0.191-0.618	0.372	0.184-0.694	0.928	0.747-1.142	1.171	0.887-1.522
		1.460	1.007 - 2.053	1.270	0.824-1.882	1.676	1.204-2.274	1.326	0.812-2.061	2.417	1.855-3.095	1.503	1.000-2.179

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020910D09	57	0.205	0.061 - 0.560	0.205	0.061-0.560	0.367	0.200-0.634	0.387	0.194-0.715	0.951	0.766-1.169	1.205	0.918-1.558
		1.524	1.054 - 2.140	1.322	0.859-1.958	1.736	1.258-2.340	1.374	0.851-2.115	2.521	1.953-3.202	1.586	1.076-2.261
020912D01	29	0.487	0.243 - 0.902	0.772	0.464-1.222	0.388	0.296-0.502	0.840	0.573-1.196	0.741	0.385-1.320	1.739	1.078-2.668
		2.170	1.601 - 2.876	1.691	1.143-2.417	1.819	1.407-2.315	1.436	0.974-2.050	2.842	1.944-4.007	2.117	1.260-3.344
020912D02	17	0.478	0.250 - 0.853	0.770	0.476-1.193	0.391	0.299-0.505	0.850	0.582-1.208	0.749	0.394-1.323	1.740	1.083-2.660
		2.125	1.573 - 2.809	1.655	1.124-2.356	1.782	1.375-2.275	1.397	0.938-2.012	2.845	1.950-4.004	2.112	1.258-3.335
020912D03	11	0.580	0.358 - 0.902	1.052	0.735-1.468	0.474	0.377-0.591	1.128	0.827-1.508	0.845	0.512-1.330	1.961	1.337-2.781
		2.640	2.068 - 3.319	2.072	1.526-2.752	2.212	1.776-2.722	1.746	1.324-2.262	3.212	2.294-4.363	2.387	1.509-3.591
020912D04	49	0.480	0.228 - 0.924	0.742	0.431-1.209	0.375	0.284-0.490	0.799	0.538-1.152	0.703	0.357-1.275	1.617	0.968-2.553
		1.876	1.284 - 2.653	1.402	0.838-2.221	1.548	1.164-2.021	1.177	0.742-1.788	2.620	1.725-3.813	1.931	1.080-3.204
020912D06	56	0.444	0.205 - 0.876	0.680	0.384-1.137	0.358	0.267-0.472	0.755	0.499-1.104	0.732	0.352-1.383	1.763	1.062-2.765
		1.904	1.327 - 2.650	1.466	0.913-2.245	1.590	1.200-2.070	1.237	0.799-1.840	2.737	1.836-3.921	2.020	1.164-3.276
020912D07	20	0.503	0.274 - 0.867	0.844	0.542-1.266	0.412	0.319-0.527	0.926	0.648-1.291	0.759	0.419-1.287	1.767	1.132-2.639
		2.183	1.619 - 2.879	1.689	1.147-2.404	1.835	1.424-2.330	1.429	0.962-2.052	2.927	2.026-4.085	2.185	1.323-3.404
020912D08	15	0.575	0.359 - 0.887	1.038	0.727-1.444	0.466	0.369-0.582	1.109	0.809-1.488	0.821	0.498-1.290	1.899	1.286-2.710
		2.426	1.880 - 3.080	1.861	1.340-2.520	2.026	1.598-2.533	1.567	1.076-2.213	2.971	2.067-4.128	2.168	1.306-3.391
020912D09	18	0.546	0.308 - 0.915	0.947	0.628-1.381	0.439	0.344-0.555	1.018	0.729-1.390	0.804	0.456-1.337	1.879	1.232-2.750
		2.419	1.846 - 3.113	1.883	1.332-2.589	2.029	1.599-2.539	1.597	1.110-2.230	3.076	2.158-4.242	2.290	1.413-3.513
020917D01	41	0.212	0.095 - 0.434	0.212	0.095-0.434	0.418	0.239-0.695	0.418	0.239-0.695	0.685	0.466-0.979	0.685	0.466-0.979
		0.936	0.610 - 1.386	0.725	0.417-1.194	1.235	0.806-1.822	0.820	0.356-1.670	1.305	0.862-1.905	0.624	0.264-1.302
020917D02	43	0.244	0.116 - 0.473	0.244	0.116-0.473	0.458	0.270-0.742	0.458	0.270-0.742	0.735	0.507-1.040	0.735	0.507-1.040
		1.063	0.712 - 1.537	0.821	0.489-1.310	1.367	0.917-1.969	0.912	0.417-1.785	1.451	0.979-2.081	0.721	0.331-1.414
020917D03	40	0.226	0.105 - 0.448	0.226	0.105-0.448	0.437	0.253-0.717	0.437	0.253-0.717	0.685	0.459-0.992	0.685	0.459-0.992
		0.972	0.639 - 1.428	0.747	0.433-1.221	1.275	0.838-1.868	0.841	0.367-1.707	1.323	0.871-1.936	0.642	0.274-1.332
020917D04	51	0.184	0.074 - 0.406	0.184	0.074-0.406	0.376	0.207-0.645	0.376	0.207-0.645	0.638	0.431-0.917	0.638	0.431-0.917
		0.778	0.476 - 1.216	0.596	0.311-1.061	1.065	0.665-1.632	0.691	0.270-1.525	1.166	0.764-1.717	0.532	0.210-1.172
020917D06	42	0.214	0.097 - 0.432	0.214	0.097-0.432	0.419	0.240-0.696	0.419	0.240-0.696	0.678	0.462-0.969	0.678	0.462-0.969
		0.889	0.568 - 1.339	0.677	0.374-1.149	1.186	0.764-1.769	0.770	0.316-1.632	1.281	0.855-1.854	0.606	0.260-1.255
020917D07	37	0.249	0.122 - 0.470	0.249	0.122-0.470	0.470	0.279-0.756	0.470	0.279-0.756	0.714	0.493-1.009	0.714	0.493-1.009
		0.946	0.617 - 1.399	0.699	0.391-1.174	1.256	0.821-1.852	0.790	0.317-1.701	1.298	0.872-1.869	0.588	0.247-1.236
020917D08	12	0.458	0.273 - 0.735	0.458	0.273-0.735	0.709	0.473-1.030	0.709	0.473-1.030	0.977	0.717-1.307	0.977	0.716-1.308
		1.387	0.967 - 1.934	0.933	0.551-1.499	1.709	1.205-2.357	1.007	0.420-2.100	1.754	1.259-2.384	0.784	0.385-1.459

Dive Date MS Ln #	DVR ID#	NMRI98 Cumulative PDCS, % Predicted	(Low-High)	Conditional PDCS, % Predicted	(Low-High)	BVM(3) Cumulative PDCS, % Predicted	(Low-High)	Conditional PDCS, % Predicted	(Low-High)	b105L3g Cumulative PDCS, % Predicted	(Low-High)	Conditional PDCS, % Predicted	(Low-High)
020917D09	31	0.220	0.101 - 0.440	0.220	0.101-0.440	0.430	0.248-0.709	0.430	0.248-0.709	0.680	0.456-0.984	0.680	0.456-0.984
		1.027	0.685 - 1.489	0.808	0.484-1.285	1.325	0.882-1.920	0.899	0.415-1.746	1.377	0.915-2.001	0.702	0.318-1.391

Table G-1
Effects of EL-RTA Code Corrections on Test Profiles: Figures in parentheses computed with corrected code.

Profile #	Depth (fsw)	Bottom Time (min)	STOPS (fsw)* 50	40	30	20	10	TST (min)	Total Time Dive (min)	Total Time Profile (min)
1	40	180			17	14	21	52	233.3	
	0	127								
	40	180			25	14	60	99	280.3	640.7
2	60	180	30	12	12	5 (28)	63 (43)	122 (125)	304.0 (307.0)	
	0	56 (53)								
	60	180	34	12	12	29 (30)	82 (81)	169	351.0	711.0 (714.0)
3	30	240				20	23	43	284.0	
	0	196								
	30	240				24	58	82	323.0	803.0
4	40	240			30	13	51	94	335.3	
	0	145								
	40	240			33	13	57 (71)	103 (117)	344.3 (358.3)	824.7 (838.7)
5	60	240	46	11	2 (29)	38 (13)	75 (76)	172 (175)	414.0 (417.0)	
	0	66 (63)								
	60	240	47	11	1 (29)	53 (28)	83 (82)	195 (197)	437.0 (439.0)	917.0 (922.0)
6	30	360				32	58	90	451.0	
	0	269								
	30	360				33	69	102	463.0	1183.0
7	40	360			44	13	74	131	492.3	
	0	228								
	40	360			44	16 (33)	99 (84)	159 (161)	520.3 (522.3)	1240.7 (1242.7)
8	60	360	60 (83)	(12)	(12)	74 (51)	98 (83)	232 (241)	594.0 (603.0)	
	0	126 (117)								
	60	360	60 (83)	(11)	(16)	102 (60)	89 (89)	251 (259)	613.0 (621.0)	1333.0 (1350.0)

* Air-breathing breaks included in stop times (15 min AIR after every 60 min O_2, with O_2 breathing started at time leave bottom of every decompression); Stop times do NOT include travel time to stops.

APPENDIX H

XVALSS_DISSUB7 DECOMPRESSION TABLES

SRDRS Operator/Tender Decompression Tables

Tables applicable under **only** the following conditions and limitations:

Subject breathing air throughout bottom time;

Subject breathing minimum 85% O_2 throughout decompression with a 15 minute air breathing break after each 60 minutes of O_2 breathing;

21.00% FIXED FO2 IN NITROGEN RATES: DESCENT 60 FPM; ASCENT 30 FPM

DEPTH (FSW)	BTM TIM (M)	TM TO FIRST STOP (M:S)	STOPS (FSW) (MIN) 70	60	50	40	30	20	10	TOTAL ASCNT TIME (M:S)	RPT GRP DES (6)
30	65	1:00							0	1:00	H
30	70	0:40							1	2:00	H
30	75	0:40							3	4:00	H
30	80	0:40							4	5:00	I
30	85	0:40							5	6:00	I
30	90	0:40							6	7:00	I
30	95	0:40							7	8:00	J
30	100	0:40							8	9:00	J
30	110	0:40							10	11:00	K
30	120	0:20						1	11	13:00	K
30	130	0:20						3	10	14:00	L
30	140	0:20						4	10	15:00	M
30	150	0:20						5	11	17:00	M
30	160	0:20						6	13	20:00	M
30	170	0:20						7	14	22:00	N
30	180	0:20						9	14	24:00	N
30	190	0:20						11	15	27:00	N
30	200	0:20						13	15	29:00	N
30	210	0:20						15	17	33:00	N
30	220	0:20						17	19	37:00	N
30	230	0:20						19	20	40:00	N
30	240	0:20						20	23	44:00	
30	250	0:20						21	25	47:00	
30	260	0:20						23	26	50:00	
30	270	0:20						24	28	53:00	
30	280	0:20						25	30	56:00	
30	290	0:20						26	32	59:00	
30	300	0:20						27	49	77:00	
30	310	0:20						28	50	79:00	
30	320	0:20						29	52	82:00	
30	330	0:20						30	53	84:00	
30	340	0:20						31	54	86:00	
30	350	0:20						31	56	88:00	
30	360	0:20						32	58	91:00	
30	370	0:20						33	59	93:00	
30	380	0:20						33	61	95:00	
30	390	0:20						34	61	96:00	
30	400	0:20						34	63	98:00	
30	410	0:20						35	64	100:00	
30	420	0:20						35	66	102:00	
30	430	0:20						36	66	103:00	

12:22 NEDU 4-AUG-2003 TBLP7R XVALSS_DISSUB7 (FEET)

21.00% FIXED FO2 IN NITROGEN RATES: DESCENT 60 FPM; ASCENT 30 FPM

DEPTH (FSW)	BTM TIM (M)	TM TO FIRST STOP (M:S)	STOPS (FSW) (MIN) 70	60	50	40	30	20	10	TOTAL ASCNT TIME (M:S)	RPT GRP DES (6)
30	440	0:20						36	68	105:00	
30	450	0:20						37	68	106:00	
30	460	0:20						37	70	108:00	
30	470	0:20						37	71	109:00	
30	480	0:20						38	72	111:00	
35	50	1:10							0	1:10	G
35	55	0:50							1	2:10	H
35	60	0:50							3	4:10	H
35	65	0:50							4	5:10	H
35	70	0:50							6	7:10	I
35	75	0:50							8	9:10	I
35	80	0:50							9	10:10	I
35	85	0:50							11	12:10	J
35	90	0:30						1	11	13:10	J
35	95	0:30						3	10	14:10	K
35	100	0:30						4	10	15:10	K
35	110	0:30						6	10	17:10	L
35	120	0:30						7	11	19:10	L
35	130	0:30						9	11	21:10	M
35	140	0:10					1	9	13	24:10	M
35	150	0:10					2	10	14	27:10	N
35	160	0:10					3	12	14	30:10	N
35	170	0:10					5	13	14	33:10	N
35	180	0:10					7	13	16	37:10	N
35	190	0:10					10	13	18	42:10	N
35	200	0:10					12	13	21	47:10	N
35	210	0:10					14	13	23	51:10	
35	220	0:10					16	13	25	55:10	
35	230	0:10					17	13	28	59:10	
35	240	0:10					19	13	45	78:10	
35	250	0:10					20	14	46	81:10	
35	260	0:10					22	13	49	85:10	
35	270	0:10					23	13	51	88:10	
35	280	0:10					25	13	52	91:10	
35	290	0:10					26	13	54	94:10	
35	300	0:10					27	13	56	97:10	
35	310	0:10					28	13	57	99:10	
35	320	0:10					29	13	59	102:10	
35	330	0:10					30	13	61	105:10	
35	340	0:10					31	13	62	107:10	

21.00% FIXED FO2 IN NITROGEN RATES: DESCENT 60 FPM; ASCENT 30 FPM

DEPTH (FSW)	BTM TIM (M)	TM TO FIRST STOP (M:S)	STOPS (FSW) (MIN) 70	60	50	40	30	20	10	TOTAL ASCNT TIME (M:S)	RPT GRP DES (6)
35	350	0:10					31	14	64	110:10	
35	360	0:10					32	13	66	112:10	
35	370	0:10					33	13	67	114:10	
35	380	0:10					34	13	68	116:10	
35	390	0:10					34	13	70	118:10	
35	400	0:10					35	13	71	120:10	
35	410	0:10					35	13	73	122:10	
35	420	0:10					36	13	74	124:10	
35	430	0:10					36	14	75	126:10	
35	440	0:10					37	13	77	128:10	
35	450	0:10					37	14	77	129:10	
35	460	0:10					38	14	78	131:10	
35	470	0:10					38	15	79	133:10	
35	480	0:10					38	16	79	134:10	
40	40	1:20							0	1:20	F
40	45	1:00							1	2:20	G
40	50	1:00							3	4:20	H
40	55	1:00							5	6:20	H
40	60	1:00							7	8:20	H
40	65	1:00							9	10:20	I
40	70	0:40						1	10	12:20	I
40	75	0:40						2	11	14:20	J
40	80	0:40						4	10	15:20	J
40	85	0:40						5	10	16:20	K
40	90	0:40						6	11	18:20	K
40	95	0:40						8	10	19:20	K
40	100	0:40						9	10	20:20	L
40	110	0:20					2	9	10	22:20	M
40	120	0:20					4	9	12	26:20	M
40	130	0:20					5	10	14	30:20	N
40	140	0:20					7	12	14	34:20	N
40	150	0:20					9	13	14	37:20	N
40	160	0:20					12	13	16	42:20	N
40	170	0:20					15	13	19	48:20	N
40	180	0:20					18	13	21	53:20	N
40	190	0:20					20	13	24	58:20	
40	200	0:20					22	13	42	78:20	
40	210	0:20					24	14	43	82:20	
40	220	0:20					27	13	46	87:20	
40	230	0:20					28	14	48	91:20	

DEPTH (FSW)	BTM TIM (M)	TM TO FIRST STOP (M:S)	STOPS (FSW) (MIN) 70	60	50	40	30	20	10	TOTAL ASCNT TIME (M:S)	RPT GRP DES (6)
40	240	0:20					30	13	51	95:20	
40	250	0:20					32	13	52	98:20	
40	260	0:20					33	13	55	102:20	
40	270	0:20					35	13	57	106:20	
40	280	0:20					36	13	59	109:20	
40	290	0:20					37	14	60	112:20	
40	300	0:20					39	13	62	115:20	
40	310	0:20					40	13	64	118:20	
40	320	0:20					41	13	66	121:20	
40	330	0:20					42	13	68	124:20	
40	340	0:20					43	13	70	127:20	
40	350	0:20					43	14	71	129:20	
40	360	0:20					44	13	74	132:20	
40	370	0:20					45	13	75	134:20	
40	380	0:20					46	29	78	154:20	
40	390	0:20					46	30	80	157:20	
40	400	0:20					47	30	81	159:20	
40	410	0:20					48	30	82	161:20	
40	420	0:20					48	32	82	163:20	
40	430	0:20					49	32	82	164:20	
40	440	0:20					49	33	83	166:20	
40	450	0:20					50	33	84	168:20	
40	460	0:20					50	35	84	170:20	
40	470	0:20					51	36	83	171:20	
40	480	0:20					51	37	84	173:20	
45	35	1:30							0	1:30	F
45	40	1:10							2	3:30	G
45	45	1:10							4	5:30	H
45	50	1:10							6	7:30	H
45	55	0:50						1	8	10:30	H
45	60	0:50						2	9	12:30	I
45	65	0:50						3	10	14:30	I
45	70	0:50						5	10	16:30	J
45	75	0:30					1	6	10	18:30	J
45	80	0:30					1	7	11	20:30	K
45	85	0:30					2	8	10	21:30	K
45	90	0:30					2	9	11	23:30	L
45	95	0:30					3	10	10	24:30	L
45	100	0:30					5	9	10	25:30	M
45	110	0:30					7	9	13	30:30	M

21.00% FIXED FO2 IN NITROGEN RATES: DESCENT 60 FPM; ASCENT 30 FPM

DEPTH (FSW)	BTM TIM (M)	TM TO FIRST STOP (M:S)	70	60	50	40	30	20	10	TOTAL ASCNT TIME (M:S)	RPT GRP DES (6)
						STOPS (FSW) (MIN)					
45	120	0:10				1	8	11	14	35:30	N
45	130	0:10				2	9	13	14	39:30	N
45	140	0:10				4	10	14	14	43:30	N
45	150	0:10				6	12	13	18	50:30	N
45	160	0:10				9	12	14	20	56:30	N
45	170	0:10				12	13	13	38	77:30	
45	180	0:10				15	12	14	41	83:30	
45	190	0:10				18	12	13	44	88:30	
45	200	0:10				20	13	13	46	93:30	
45	210	0:10				23	12	13	49	98:30	
45	220	0:10				25	12	13	52	103:30	
45	230	0:10				27	12	13	54	107:30	
45	240	0:10				29	12	13	56	111:30	
45	250	0:10				30	13	13	58	115:30	
45	260	0:10				32	12	13	61	119:30	
45	270	0:10				34	12	29	50	126:30	
45	280	0:10				35	12	29	53	130:30	
45	290	0:10				36	13	29	54	133:30	
45	300	0:10				38	12	29	72	152:30	
45	310	0:10				39	12	29	74	155:30	
45	320	0:10				40	12	29	76	158:30	
45	330	0:10				41	12	29	77	160:30	
45	340	0:10				42	12	29	79	163:30	
45	350	0:10				43	12	30	80	166:30	
45	360	0:10				44	12	31	80	168:30	
45	370	0:10				44	13	31	82	171:30	
45	380	0:10				45	13	32	82	173:30	
45	390	0:10				46	12	33	83	175:30	
45	400	0:10				47	30	19	83	180:30	
45	410	0:10				47	30	21	83	182:30	
45	420	0:10				48	30	22	84	185:30	
45	430	0:10				48	30	25	82	186:30	
45	440	0:10				49	30	26	82	188:30	
45	450	0:10				49	30	27	83	190:30	
45	460	0:10				50	30	28	83	192:30	
45	470	0:10				50	30	30	83	194:30	
45	480	0:10				51	30	31	82	195:30	
50	25	1:40							0	1:40	E
50	30	1:20							1	2:40	F
50	35	1:20							2	3:40	G

21.00% FIXED FO2 IN NITROGEN RATES: DESCENT 60 FPM; ASCENT 30 FPM

DEPTH (FSW)	BTM TIM (M)	TM TO FIRST STOP (M:S)	STOPS (FSW) (MIN) 70	60	50	40	30	20	10	TOTAL ASCNT TIME (M:S)	RPT GRP DES (6)
50	40	1:20							4	5:40	G
50	45	1:00						1	6	8:40	H
50	50	1:00						2	8	11:40	H
50	55	1:00						3	10	14:40	I
50	60	0:40					1	4	10	16:40	I
50	65	0:40					1	6	10	18:40	J
50	70	0:40					2	7	10	20:40	K
50	75	0:40					3	8	10	22:40	K
50	80	0:40					4	9	10	24:40	L
50	85	0:20				1	4	9	11	26:40	L
50	90	0:20				1	6	9	10	27:40	M
50	95	0:20				1	7	9	12	30:40	M
50	100	0:20				2	7	9	14	33:40	M
50	110	0:20				3	9	11	14	38:40	N
50	120	0:20				5	9	14	14	43:40	N
50	130	0:20				7	12	13	15	48:40	N
50	140	0:20				11	12	13	19	56:40	N
50	150	0:20				15	12	13	37	78:40	
50	160	0:20				18	12	14	39	84:40	
50	170	0:20				21	13	13	43	91:40	
50	180	0:20				24	13	13	46	97:40	
50	190	0:20				27	13	13	48	102:40	
50	200	0:20				30	12	13	52	108:40	
50	210	0:20				32	13	13	54	113:40	
50	220	0:20				35	12	29	44	121:40	
50	230	0:20				37	12	29	46	125:40	
50	240	0:20				39	12	29	49	130:40	
50	250	0:20				40	13	28	67	149:40	
50	260	0:20				42	12	29	69	153:40	
50	270	0:20				44	12	28	72	157:40	
50	280	0:20				45	13	28	74	161:40	
50	290	0:20				47	30	13	76	167:40	
50	300	0:20				48	30	13	78	170:40	
50	310	0:20				49	30	15	79	174:40	
50	320	0:20				50	30	16	80	177:40	
50	330	0:20				51	30	17	81	180:40	
50	340	0:20				52	30	18	82	183:40	
50	350	0:20				53	30	19	82	185:40	
50	360	0:20				54	30	20	83	188:40	
50	370	0:20				55	30	22	83	191:40	
50	380	0:20				56	29	24	83	193:40	

21.00% FIXED FO2 IN NITROGEN RATES: DESCENT 60 FPM; ASCENT 30 FPM

DEPTH (FSW)	BTM TIM (M)	TM TO FIRST STOP (M:S)	STOPS (FSW) (MIN)							TOTAL ASCNT TIME (M:S)	RPT GRP DES (6)
			70	60	50	40	30	20	10		
50	390	0:20				57	29	26	83	196:40	
50	400	0:20				57	30	27	83	198:40	
50	410	0:20				58	29	30	82	200:40	
50	420	0:20				78	12	32	82	205:40	
50	430	0:20				78	13	33	82	207:40	
50	440	0:20				79	12	35	82	209:40	
50	450	0:20				80	12	36	97	226:40	
50	460	0:20				80	12	38	97	228:40	
55	15	1:50							0	1:50	C
55	20	1:30							1	2:50	D
55	25	1:30							1	2:50	E
55	30	1:30							1	2:50	F
55	35	1:30							4	5:50	G
55	40	1:10						1	6	8:50	H
55	45	1:10						3	7	11:50	H
55	50	0:50					1	3	9	14:50	I
55	55	0:50					2	4	10	17:50	I
55	60	0:50					3	5	11	20:50	J
55	65	0:50					4	7	10	22:50	K
55	70	0:30				1	4	8	10	24:50	K
55	75	0:30				2	4	9	10	26:50	L
55	80	0:30				2	6	9	10	28:50	L
55	85	0:30				3	6	9	11	30:50	M
55	90	0:30				3	8	9	13	34:50	M
55	95	0:10			1	3	8	10	14	37:50	M
55	100	0:10			1	4	9	11	14	40:50	M
55	110	0:10			2	6	9	13	14	45:50	N
55	120	0:10			2	8	12	13	16	52:50	N
55	130	0:10			4	11	12	13	34	75:50	N
55	140	0:10			7	12	12	13	38	83:50	
55	150	0:10			11	12	12	13	41	90:50	
55	160	0:10			15	12	12	13	44	97:50	
55	170	0:10			19	11	13	13	47	104:50	
55	180	0:10			22	11	13	29	37	113:50	
55	190	0:10			25	11	13	29	40	119:50	
55	200	0:10			28	11	12	29	44	125:50	
55	210	0:10			30	12	12	28	47	130:50	
55	220	0:10			32	12	12	29	65	151:50	
55	230	0:10			35	11	13	28	68	156:50	
55	240	0:10			37	11	30	14	70	163:50	

DEPTH (FSW)	BTM TIM (M)	TM TO FIRST STOP (M:S)	STOPS (FSW) (MIN) 70	60	50	40	30	20	10	TOTAL ASCNT TIME (M:S)	RPT GRP DES (6)
55	250	0:10			39	11	30	13	73	167:50	
55	260	0:10			41	11	30	13	75	171:50	
55	270	0:10			42	12	29	14	77	175:50	
55	280	0:10			44	11	30	14	79	179:50	
55	290	0:10			45	12	29	16	80	183:50	
55	300	0:10			47	11	29	18	80	186:50	
55	310	0:10			48	31	12	19	81	192:50	
55	320	0:10			49	31	12	20	82	195:50	
55	330	0:10			50	31	12	22	83	199:50	
55	340	0:10			51	31	12	24	83	202:50	
55	350	0:10			52	31	12	26	83	205:50	
55	360	0:10			53	31	12	28	82	207:50	
55	370	0:10			54	30	13	30	97	225:50	
55	380	0:10			55	30	12	33	97	228:50	
55	390	0:10			56	30	12	34	97	230:50	
55	400	0:10			56	31	12	51	84	235:50	
55	410	0:10			57	30	13	52	84	237:50	
55	420	0:10			58	30	13	54	84	240:50	
55	430	0:10			58	30	15	54	84	242:50	
55	440	0:10			80	11	15	55	84	246:50	
55	450	0:10			80	12	16	55	84	248:50	
55	460	0:10			81	11	17	56	84	250:50	
55	470	0:10			81	12	17	57	84	252:50	
55	480	0:10			81	12	18	58	83	253:50	
60	15	2:00							0	2:00	C
60	20	1:40							1	3:00	D
60	25	1:20						1	0	3:00	F
60	30	1:20						1	2	5:00	G
60	35	1:20						1	5	8:00	H
60	40	1:20						3	7	12:00	H
60	45	1:00					1	4	8	15:00	I
60	50	1:00					3	3	11	19:00	I
60	55	1:00					4	5	11	22:00	J
60	60	0:40				1	4	7	10	24:00	K
60	65	0:40				2	4	8	11	27:00	K
60	70	0:40				3	4	10	10	29:00	L
60	75	0:20			1	3	6	9	10	31:00	M
60	80	0:20			1	4	7	9	11	34:00	M
60	85	0:20			2	3	8	9	14	38:00	M
60	90	0:20			3	4	8	10	14	41:00	M

21.00% FIXED FO2 IN NITROGEN RATES: DESCENT 60 FPM; ASCENT 30 FPM

DEPTH (FSW)	BTM TIM (M)	TM TO FIRST STOP (M:S)	STOPS (FSW) (MIN) 70	60	50	40	30	20	10	TOTAL ASCNT TIME (M:S)	RPT GRP DES (6)
60	95	0:20			3	5	8	12	14	44:00	N
60	100	0:20			3	7	8	13	15	48:00	N
60	110	0:20			5	7	12	13	15	54:00	N
60	120	0:20			7	10	13	13	34	79:00	N
60	130	0:20			11	11	13	13	37	87:00	
60	140	0:20			15	12	12	13	41	95:00	
60	150	0:20			19	12	12	14	44	103:00	
60	160	0:20			23	12	12	29	36	114:00	
60	170	0:20			27	12	12	29	38	120:00	
60	180	0:20			30	12	12	29	42	127:00	
60	190	0:20			33	12	12	28	46	133:00	
60	200	0:20			36	12	30	13	64	157:00	
60	210	0:20			39	11	30	13	67	162:00	
60	220	0:20			41	12	29	14	70	168:00	
60	230	0:20			44	11	29	14	72	172:00	
60	240	0:20			46	11	29	14	75	177:00	
60	250	0:20			48	31	12	14	77	184:00	
60	260	0:20			50	30	13	15	79	189:00	
60	270	0:20			51	31	12	17	80	193:00	
60	280	0:20			53	30	13	18	81	197:00	
60	290	0:20			55	30	12	20	82	201:00	
60	300	0:20			56	30	12	22	82	204:00	
60	310	0:20			57	30	13	24	82	208:00	
60	320	0:20			79	12	12	27	97	229:00	
60	330	0:20			80	12	12	29	97	232:00	
60	340	0:20			81	12	12	47	84	238:00	
60	350	0:20			82	12	12	49	84	241:00	
60	360	0:20			83	12	12	51	83	243:00	
60	370	0:20			84	11	13	53	83	246:00	
60	380	0:20			85	11	14	53	84	249:00	
60	390	0:20			85	12	15	54	83	251:00	
60	400	0:20			86	12	15	55	84	254:00	
60	410	0:20			87	11	17	56	83	256:00	
60	420	0:20			87	12	18	56	83	258:00	
60	430	0:20			88	11	19	57	83	260:00	
60	440	0:20			88	12	19	58	83	262:00	
60	450	0:20			89	11	21	58	83	264:00	
60	460	0:20			89	12	21	59	83	266:00	
60	470	0:20			90	11	22	60	83	268:00	
60	480	0:20			90	12	22	61	83	270:00	

12:22 NEDU 4-AUG-2003 TBLP7R XVALSS_DISSUB7 (FEET)

21.00% FIXED FO2 IN NITROGEN RATES: DESCENT 60 FPM; ASCENT 30 FPM

DEPTH (FSW)	BTM TIM (M)	TM TO FIRST STOP (M:S)	STOPS (FSW) (MIN) 70	60	50	40	30	20	10	TOTAL ASCNT TIME (M:S)	RPT GRP DES (6)
65	10	1:50							0	1:10	A
65	15	1:50							1	3:10	C
65	20	1:30						1	0	3:10	E
65	25	1:30						1	1	4:10	F
65	30	1:30						1	4	7:10	G
65	35	1:30						3	6	11:10	H
65	40	1:10					1	4	8	15:10	H
65	45	1:10					3	4	9	18:10	I
65	50	0:50				1	3	5	11	22:10	J
65	55	0:50				2	4	7	10	25:10	J
65	60	0:50				3	4	8	11	28:10	K
65	65	0:30			1	3	5	9	10	30:10	L
65	70	0:30			2	3	6	9	11	33:10	L
65	75	0:30			3	3	7	9	12	36:10	M
65	80	0:10		1	3	3	8	9	14	40:10	M
65	85	0:10		1	3	5	8	11	14	44:10	M
65	90	0:10		2	3	6	8	12	14	47:10	N
65	95	0:10		2	3	7	10	13	14	51:10	N
65	100	0:10		3	3	8	11	13	14	54:10	N
65	110	0:10		3	6	10	12	13	33	79:10	N
65	120	0:10		4	9	11	13	13	37	89:10	
65	130	0:10		7	11	12	12	13	41	98:10	
65	140	0:10		12	11	11	13	29	32	110:10	
65	150	0:10		16	11	12	12	29	36	118:10	
65	160	0:10		20	11	12	12	29	39	125:10	
65	170	0:10		24	11	12	30	13	44	136:10	
65	180	0:10		28	11	11	30	13	62	157:10	
65	190	0:10		31	11	11	30	13	66	164:10	
65	200	0:10		34	11	11	30	13	68	169:10	
65	210	0:10		37	11	30	13	13	72	178:10	
65	220	0:10		39	11	31	12	13	75	183:10	
65	230	0:10		42	10	31	12	14	77	188:10	
65	240	0:10		44	11	30	12	16	78	193:10	
65	250	0:10		46	11	30	12	17	80	198:10	
65	260	0:10		48	31	12	12	19	81	205:10	
65	270	0:10		50	31	12	12	20	83	210:10	
65	280	0:10		51	32	11	12	24	97	229:10	
65	290	0:10		53	31	12	12	41	84	235:10	
65	300	0:10		54	31	12	12	44	84	239:10	
65	310	0:10		56	31	11	12	47	83	242:10	
65	320	0:10		57	31	11	13	48	84	246:10	

21.00% FIXED FO2 IN NITROGEN RATES: DESCENT 60 FPM; ASCENT 30 FPM

DEPTH (FSW)	BTM TIM (M)	TM TO FIRST STOP (M:S)	STOPS (FSW) (MIN) 70	60	50	40	30	20	10	TOTAL ASCNT TIME (M:S)	RPT GRP DES (6)
65	330	0:10		58	31	11	13	50	84	249:10	
65	340	0:10		81	11	12	13	52	83	254:10	
65	350	0:10		82	11	12	14	53	83	257:10	
65	360	0:10		83	11	12	15	54	83	260:10	
65	370	0:10		84	11	11	17	55	83	263:10	
65	380	0:10		85	11	11	18	56	83	266:10	
65	390	0:10		85	11	12	19	20	121	270:10	
65	400	0:10		86	11	12	19	9	133	272:10	
65	410	0:10		87	11	11	21	58	83	273:10	
65	420	0:10		87	11	12	22	59	82	275:10	
65	430	0:10		88	11	11	23	60	83	278:10	
65	440	0:10		88	11	12	40	47	82	282:10	
65	450	0:10		89	11	11	41	48	83	285:10	
65	460	0:10		89	11	12	41	49	98	302:10	
65	470	0:10		90	11	11	43	49	100	306:10	
65	480	0:10		90	11	13	42	50	101	309:10	
70	10	2:00							0	2:20	A
70	15	2:00							1	3:20	C
70	20	1:40						1	0	3:20	E
70	25	1:20					1	0	2	5:20	F
70	30	1:20					1	1	5	9:20	G
70	35	1:20					1	3	7	13:20	H
70	40	1:20					3	4	8	17:20	I
70	45	1:00				1	4	4	10	21:20	J
70	50	1:00				3	3	7	10	25:20	J
70	55	0:40			1	3	4	8	10	28:20	K
70	60	0:40			2	3	4	10	10	31:20	L
70	65	0:40			3	3	6	9	11	34:20	L
70	70	0:20		1	3	3	8	9	11	37:20	M
70	75	0:20		2	3	4	8	9	14	42:20	M
70	80	0:20		3	3	5	8	11	14	46:20	M
70	85	0:20		3	3	7	8	13	14	50:20	N
70	90	0:20		4	3	7	10	13	14	53:20	N
70	95	0:20		4	4	8	12	13	15	58:20	N
70	100	0:20		5	5	9	12	13	32	78:20	N
70	110	0:20		6	8	11	13	13	36	89:20	
70	120	0:20		9	11	11	13	13	40	99:20	
70	130	0:20		14	11	12	12	29	32	112:20	
70	140	0:20		19	11	12	12	28	36	120:20	
70	150	0:20		24	11	11	30	14	40	132:20	

12:22 NEDU 4-AUG-2003 TBLP7R XVALSS_DISSUB7 (FEET)

21.00% FIXED FO2 IN NITROGEN RATES: DESCENT 60 FPM; ASCENT 30 FPM

DEPTH (FSW)	BTM TIM (M)	TM TO FIRST STOP (M:S)	STOPS (FSW) (MIN) 70	60	50	40	30	20	10	TOTAL ASCNT TIME (M:S)	RPT GRP DES (6)
70	160	0:20		28	11	11	30	13	60	155:20	
70	170	0:20		32	11	11	30	13	63	162:20	
70	180	0:20		35	11	12	29	13	67	169:20	
70	190	0:20		39	11	30	13	13	70	178:20	
70	200	0:20		42	11	30	12	13	74	184:20	
70	210	0:20		45	10	31	12	13	77	190:20	
70	220	0:20		47	11	30	12	16	77	195:20	
70	230	0:20		50	31	12	12	17	79	203:20	
70	240	0:20		52	31	12	12	19	80	208:20	
70	250	0:20		54	31	12	12	21	96	228:20	
70	260	0:20		56	31	11	13	39	84	236:20	
70	270	0:20		58	30	12	12	42	84	240:20	
70	280	0:20		81	11	12	12	45	83	246:20	
70	290	0:20		83	11	11	13	47	83	250:20	
70	300	0:20		84	11	12	12	50	83	254:20	
70	310	0:20		85	11	12	13	26	109	258:20	
70	320	0:20		87	11	11	15	52	83	261:20	
70	330	0:20		88	11	11	16	53	83	264:20	
70	340	0:20		89	11	11	17	55	83	268:20	
70	350	0:20		90	11	11	19	55	83	271:20	
70	360	0:20		91	11	11	20	56	83	274:20	

SURFACE INTERVAL CREDIT TABLE (SICT_6LF-XVAL_SS-DISSUB_7.tbl)

DEPTH= 0.0 FEET PAN2= 24.57 PVN2= 28.70 HLFTM= 180.0 MIREF=34.76
PACO2= 1.50 PVCO2= 2.30 PVO2= 2.00 PH2O= 0.00 AMBAO2= 0.00 PBOVP= 0.00

SURFACE INTERVAL BREATHING AIR

START																
A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1:58
B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1:22
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1:21	3:19
C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1:03	2:23
	-	-	-	-	-	-	-	-	-	-	-	-	-	1:02	2:22	4:20
D	-	-	-	-	-	-	-	-	-	-	-	-	-	0:51	1:52	3:13
	-	-	-	-	-	-	-	-	-	-	-	-	0:50	1:51	3:12	5:10
E	-	-	-	-	-	-	-	-	-	-	-	-	0:43	1:32	2:34	3:55
	-	-	-	-	-	-	-	-	-	-	-	0:42	1:31	2:33	3:54	5:52
F	-	-	-	-	-	-	-	-	-	-	-	0:38	1:19	2:09	3:11	4:31
	-	-	-	-	-	-	-	-	-	-	0:37	1:18	2:08	3:10	4:30	6:28
G	-	-	-	-	-	-	-	-	-	-	0:37	1:14	1:55	2:45	3:47	5:08
	-	-	-	-	-	-	-	-	-	0:36	1:13	1:54	2:44	3:46	5:07	7:04
H	-	-	-	-	-	-	-	-	-	0:37	1:13	1:50	2:32	3:21	4:23	5:44
	-	-	-	-	-	-	-	-	0:36	1:12	1:49	2:31	3:20	4:22	5:43	7:41
I	-	-	-	-	-	-	-	-	0:37	1:13	1:49	2:26	3:08	3:57	4:59	6:20
	-	-	-	-	-	-	-	0:36	1:12	1:48	2:25	3:07	3:56	4:58	6:19	8:17
J	-	-	-	-	-	-	-	0:37	1:13	1:49	2:26	3:02	3:44	4:34	5:35	6:56
	-	-	-	-	-	-	0:36	1:12	1:48	2:25	3:01	3:43	4:33	5:34	6:55	8:53
K	-	-	-	-	-	-	0:37	1:13	1:49	2:26	3:02	3:38	4:20	5:10	6:11	7:32
	-	-	-	-	-	0:36	1:12	1:48	2:25	3:01	3:37	4:19	5:09	6:10	7:31	9:29
L	-	-	-	-	-	0:37	1:13	1:49	2:26	3:02	3:38	4:14	4:56	5:46	6:47	8:08
	-	-	-	-	0:36	1:12	1:48	2:25	3:01	3:37	4:13	4:55	5:45	6:46	8:07	10:05
M	-	-	-	-	0:37	1:13	1:49	2:26	3:02	3:38	4:14	4:51	5:32	6:22	7:24	8:44
	-	-	-	0:36	1:12	1:48	2:25	3:01	3:37	4:13	4:50	5:31	6:21	7:23	8:43	10:41
N	-	-	-	0:37	1:13	1:49	2:26	3:02	3:38	4:14	4:50	5:27	6:08	6:58	8:00	9:20
	-	-	0:36	1:12	1:48	2:25	3:01	3:37	4:13	4:49	5:26	6:07	6:57	7:59	9:19	11:17
O	-	-	0:37	1:13	1:49	2:26	3:02	3:38	4:14	4:50	5:26	6:03	6:45	7:34	8:36	9:57
	-	0:36	1:12	1:48	2:25	3:01	3:37	4:13	4:49	5:25	6:02	6:44	7:33	8:35	9:56	11:54
Z	-	0:37	1:13	1:49	2:26	3:02	3:38	4:14	4:50	5:26	6:02	6:39	7:21	8:10	9:12	10:33
	0:36	1:12	1:48	2:25	3:01	3:37	4:13	4:49	5:25	6:01	6:38	7:20	8:09	9:11	10:32	12:30
FINAL	Z	O	N	M	L	K	J	I	H	G	F	E	D	C	B	A

REPETS BREATHING 21.00 % FIXED FO2 IN NITROGEN

DEPTH																
10	-	-	-	-	720	678	499	394	320	262	215	175	140	109	82	57
15	511	433	374	325	285	249	218	191	166	143	122	102	84	67	51	37
20	269	243	220	199	179	161	144	128	113	99	85	72	60	49	37	27
25	188	173	159	145	132	120	108	97	86	76	66	56	47	38	29	21
30	146	135	124	114	105	95	86	78	69	61	53	46	38	31	24	17
35	119	110	102	94	87	79	72	65	58	51	45	38	32	26	20	14
40	100	94	87	80	74	68	62	56	50	44	39	33	28	23	17	12
45	87	81	76	70	65	59	54	49	44	39	34	29	24	20	15	11
50	77	72	67	62	57	52	48	43	39	34	30	26	22	18	14	10
55	69	64	60	56	51	47	43	39	35	31	27	23	20	16	12	9
60	62	58	54	50	46	43	39	35	32	28	25	21	18	14	11	8
70	52	49	45	42	39	36	33	30	27	24	21	18	15	12	9	6

APPENDIX I

COMPARISON OF SPECIFIC SRDRS TENDER MANAGEMENT PLANS FOR 5-HR RESCUE SORTIES TO A DISSUB PRESSURIZED AT 60 FSW EQUIVALENT AIR DEPTH

Figure I-1 (on following page I-2). Pressure and inspired FO_2 profiles of four two-man Tender teams supporting SDC1 operation in a hypothetical DISSUB rescue scenario. Tender decompressions prescribed by present XVALSS_DISSUB7 Decompression Tables. The three SDC1 decompression schedules for rescuees are also shown in each panel.

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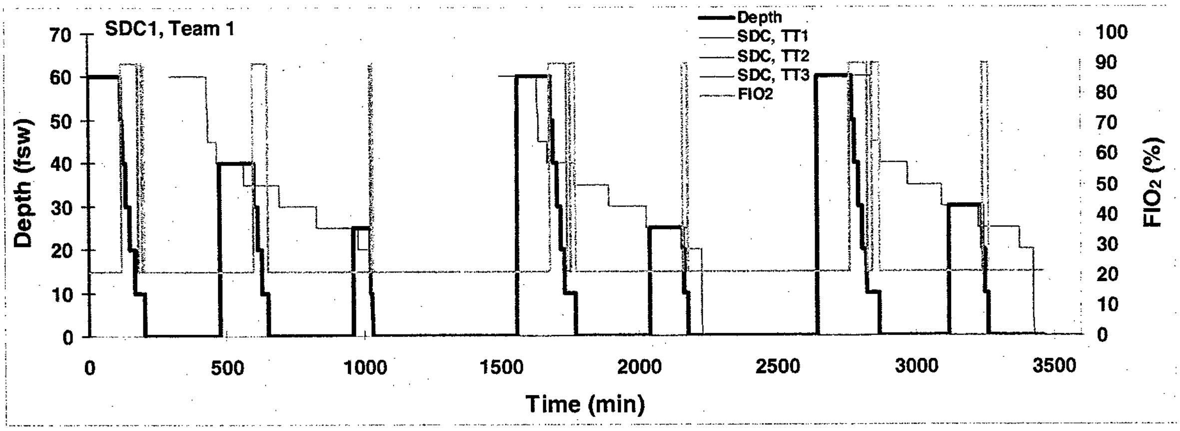
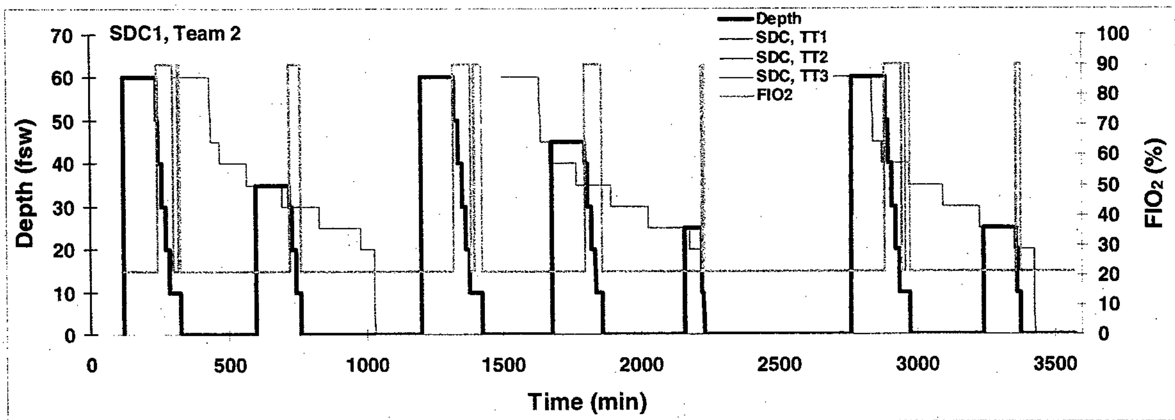
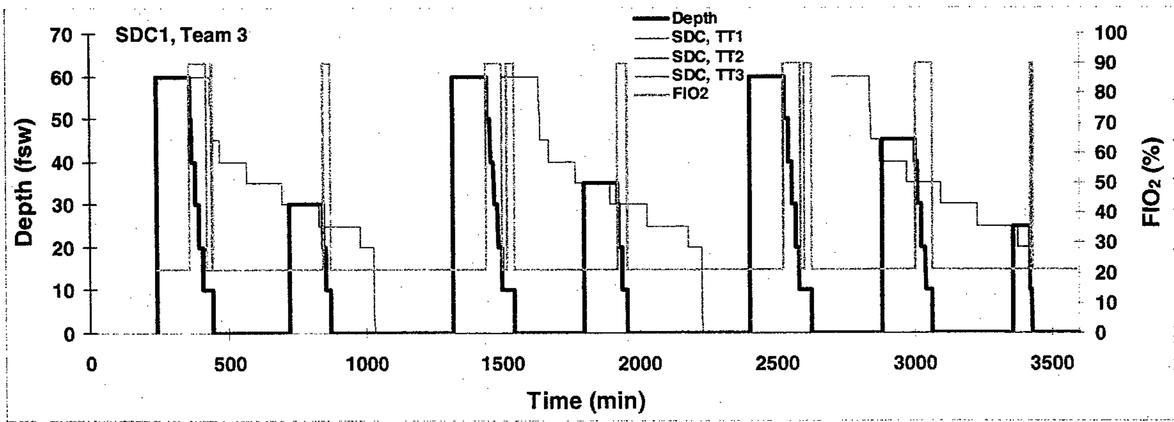

SDC1, Team 1
Depth
SDC, TT1
SDC, TT2
SDC, TT3
FIO2
Depth (fsw)
FIO2 (%)
Time (min)


SDC1, Team 2
Depth
SDC, TT1
SDC, TT2
SDC, TT3
FIO2
Depth (fsw)
FIO2 (%)
Time (min)


SDC1, Team 3
Depth
SDC, TT1
SDC, TT2
SDC, TT3
FIO2
Depth (fsw)
FIO2 (%)
Time (min)

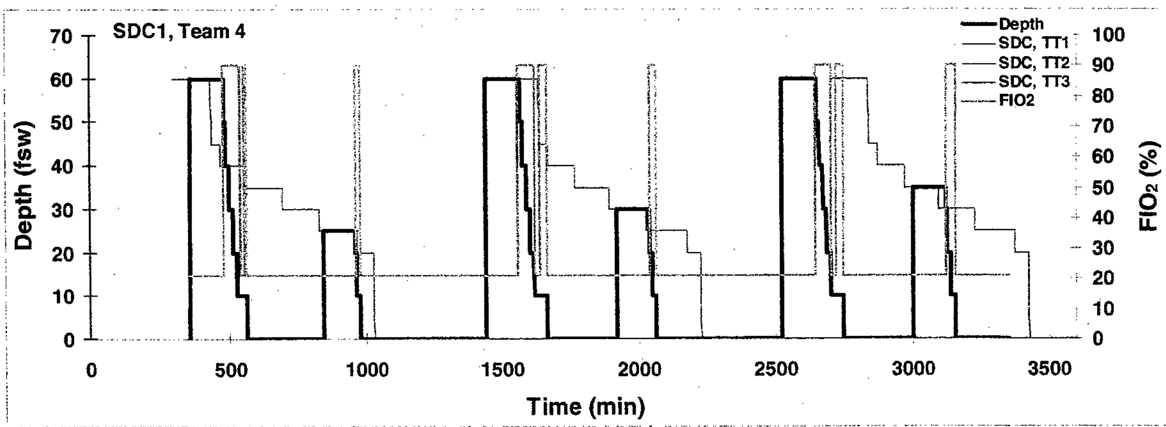
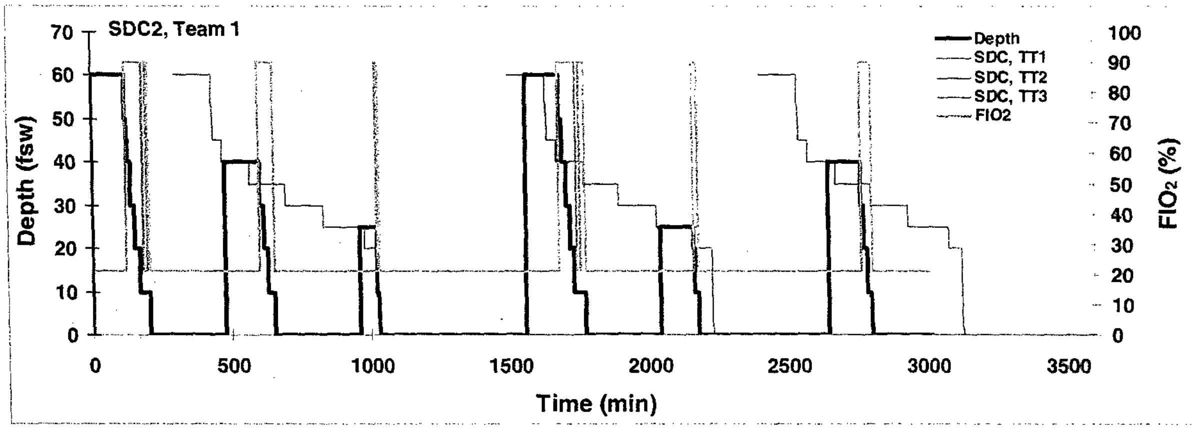

SDC1, Team 4
Depth
SDC, TT1
SDC, TT2
SDC, TT3
FIO2
Depth (fsw)
FIO2 (%)
Time (min)

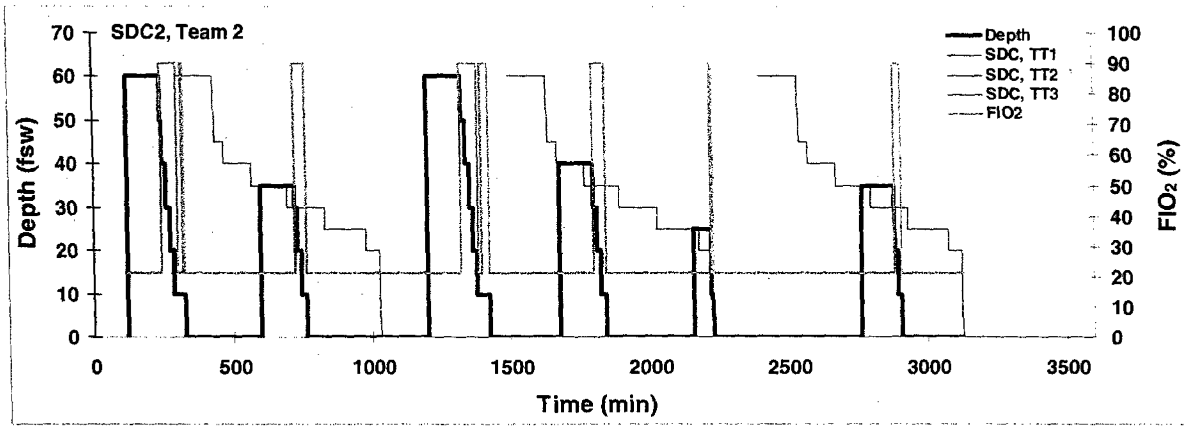
Table I-1
Estimated DCS Risks of SRDRS SDC1 Tender Profiles in Figure I-1

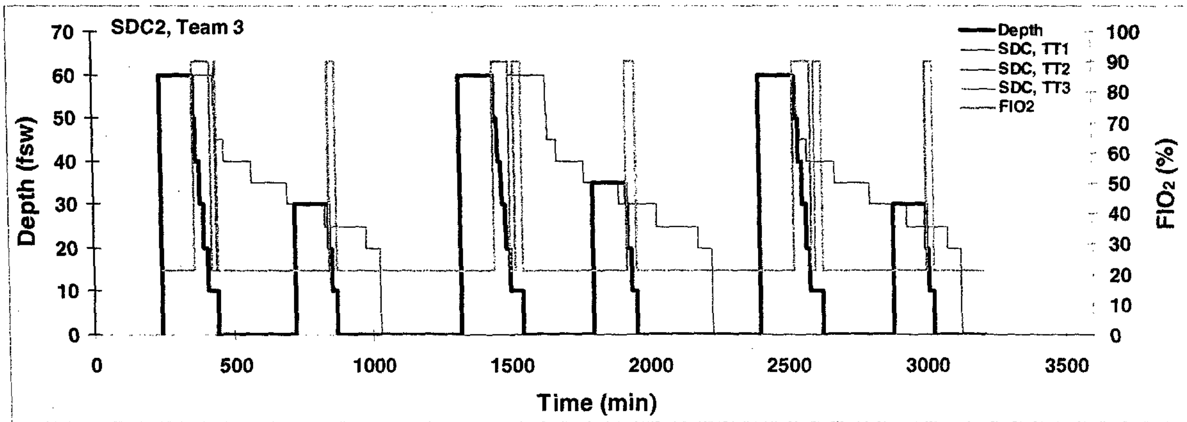
SRDRS_Tender_SDC1_R60Sat

	NMRI98				BVM(3)				b105L3g			
	Cumulative PDCS, %		Conditional PDCS, %		Cumulative PDCS, %		Conditional PDCS, %		Cumulative PDCS, %		Conditional PDCS, %	
Profile	Predicted	(Low-High)	Predicted	(Low-High)	Predicted	(Low-High)	Predicted	(Low-High)	Predicted	(Low-High)	Predicted	(Low-High)
TM1	0.579	0.161-1.613	0.579	0.161-1.613	0.317	0.164-0.573	0.317	0.164-0.573	1.850	1.535-2.210	1.874	1.544-2.255
	0.934	0.300-2.327	0.357	0.014-2.763	0.704	0.381-1.215	0.388	0.087-1.263	3.068	2.498-3.725	1.241	0.813-1.827
	1.058	0.384-2.426	0.126	0.000-11.008	0.704	0.381-1.215	0.000	0.000-0.004	3.466	2.744-4.312	0.410	0.071-1.556
	1.710	0.595-3.954	0.659	0.030-4.434	1.198	0.679-1.982	0.497	0.057-2.319	5.126	4.150-6.244	1.750	0.999-2.862
	2.039	0.796-4.352	0.334	0.000-9.834	1.515	0.848-2.523	0.321	0.001-6.062	6.250	4.978-7.712	1.184	0.416-2.761
	2.624	0.994-5.645	0.596	0.002-8.808	1.993	1.136-3.259	0.485	0.004-6.138	7.761	6.268-9.453	1.645	0.636-3.560
	3.069	1.260-6.237	0.457	0.000-14.048	2.421	1.390-3.923	0.436	0.000-10.657	9.027	7.138-11.180	1.372	0.314-4.110
TM2	0.579	0.161-1.613	0.579	0.161-1.613	0.317	0.164-0.573	0.317	0.164-0.573	1.850	1.535-2.210	1.874	1.544-2.255
	0.872	0.283-2.166	0.295	0.008-2.736	0.638	0.333-1.136	0.322	0.054-1.261	2.982	2.436-3.610	1.153	0.755-1.698
	1.487	0.513-3.476	0.620	0.038-3.758	1.153	0.649-1.920	0.519	0.074-2.146	4.517	3.679-5.476	1.619	0.940-2.617
	2.130	0.847-4.482	0.653	0.019-5.222	1.778	1.060-2.812	0.632	0.048-3.487	6.049	4.781-7.515	1.605	0.708-3.175
	2.253	0.937-4.596	0.125	0.000-45.713	1.799	1.053-2.886	0.022	0.000-99.930	6.535	5.006-8.329	0.516	0.012-4.668
	2.930	1.162-6.100	0.692	0.004-8.655	2.314	1.370-3.666	0.524	0.003-7.145	8.214	6.420-10.280	1.830	0.604-4.359
	3.266	1.375-6.517	0.345	0.000-22.048	2.636	1.543-4.204	0.330	0.000-19.066	9.342	7.210-11.799	1.228	0.159-4.956
TM3	0.579	0.161-1.613	0.579	0.161-1.613	0.317	0.164-0.573	0.317	0.164-0.573	1.850	1.535-2.210	1.874	1.544-2.255
	0.862	0.292-2.082	0.285	0.008-2.585	0.606	0.310-1.096	0.290	0.040-1.273	2.968	2.444-3.568	1.140	0.771-1.633
	1.450	0.502-3.388	0.593	0.035-3.688	1.095	0.604-1.852	0.492	0.067-2.097	4.474	3.677-5.381	1.585	0.950-2.497
	2.037	0.846-4.171	0.595	0.018-4.791	1.653	0.960-2.669	0.564	0.033-3.512	5.903	4.713-7.271	1.496	0.688-2.879
	2.710	1.117-5.521	0.687	0.008-7.119	2.215	1.319-3.495	0.572	0.009-5.801	7.506	6.032-9.182	1.744	0.694-3.693
	3.377	1.481-6.552	0.684	0.003-9.441	2.854	1.747-4.394	0.654	0.005-7.899	9.073	7.110-11.320	1.695	0.465-4.525
	3.498	1.574-6.669	0.125	0.000-74.346	2.878	1.741-4.471	0.025	0.000-99.998	9.567	7.320-12.166	0.544	0.001-9.351
TM4	0.579	0.161-1.613	0.579	0.161-1.613	0.317	0.164-0.573	0.317	0.164-0.573	1.850	1.535-2.210	1.874	1.544-2.255
	0.815	0.282-1.944	0.237	0.004-2.612	0.537	0.263-1.007	0.221	0.017-1.362	2.920	2.439-3.466	1.091	0.767-1.512
	1.371	0.469-3.235	0.561	0.032-3.535	0.993	0.531-1.726	0.459	0.062-1.968	4.407	3.653-5.261	1.563	0.970-2.398
	1.807	0.721-3.817	0.442	0.004-5.331	1.415	0.777-2.391	0.425	0.011-3.780	5.664	4.593-6.886	1.314	0.620-2.492
	2.434	0.954-5.144	0.638	0.007-6.833	1.933	1.098-3.169	0.525	0.009-5.277	7.225	5.884-8.740	1.692	0.743-3.354
	3.036	1.321-5.947	0.617	0.002-8.694	2.499	1.464-3.988	0.578	0.003-7.557	8.682	6.882-10.735	1.571	0.470-3.999

Figure I-2 (on following page I-5). Pressure and inspired FO_2 profiles of four two-man Tender teams supporting SDC2 operation in a hypothetical DISSUB rescue scenario. Tender decompressions prescribed by present XVALSS_DISSUB7 Decompression Tables. The three SDC2 decompression schedules for rescuees are also shown in each panel.


SDC2, Team 1
Depth (fsw)
Time (min)
FIO2 (%)
Depth
SDC, TT1
SDC, TT2
SDC, TT3
FIO2


SDC2, Team 2
Depth (fsw)
Time (min)
FIO2 (%)
Depth
SDC, TT1
SDC, TT2
SDC, TT3
FIO2


SDC2, Team 3
Depth (fsw)
Time (min)
FIO2 (%)
Depth
SDC, TT1
SDC, TT2
SDC, TT3
FIO2

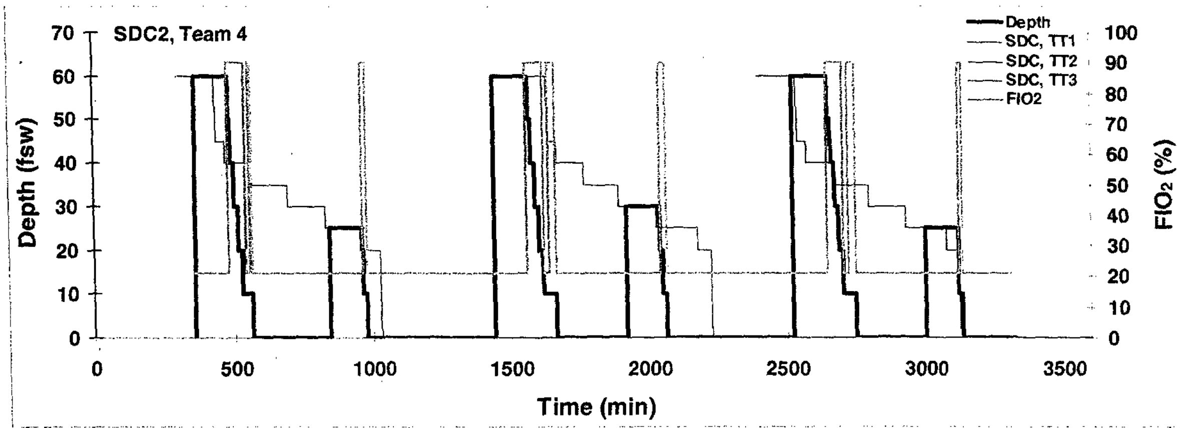
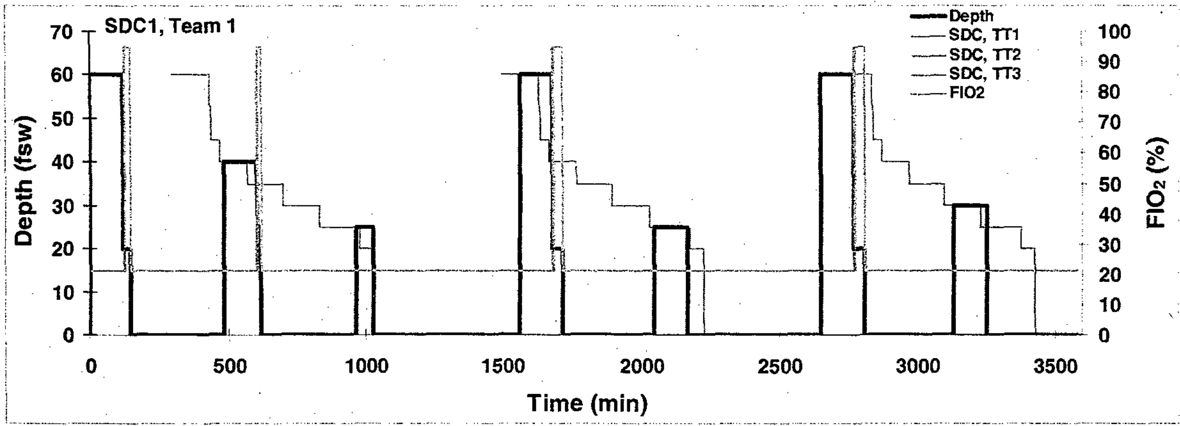

SDC2, Team 4
Depth (fsw)
Time (min)
FIO2 (%)
Depth
SDC, TT1
SDC, TT2
SDC, TT3
FIO2

Table I-2
Estimated DCS Risks of SRDRS SDC2 Tender Profiles in Figure I-2

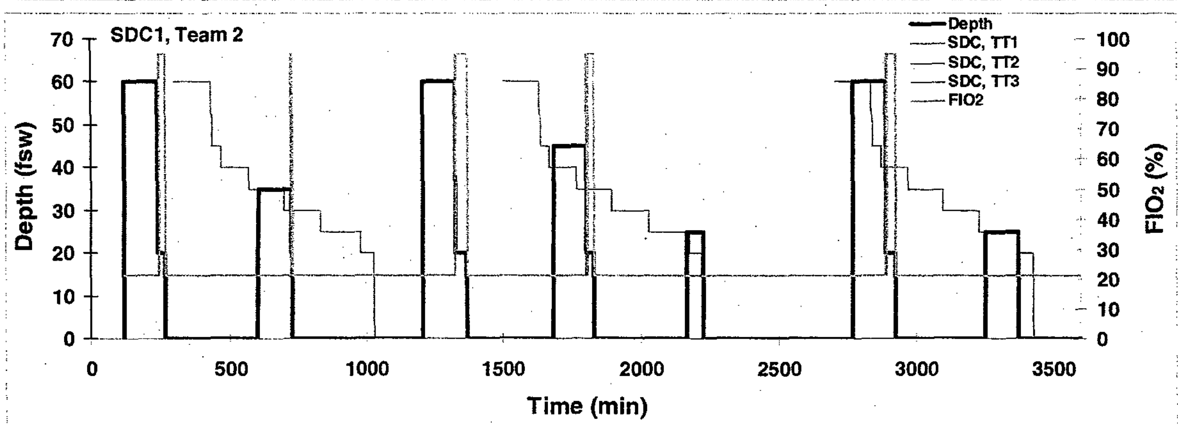
SRDRS_Tender_SDC2_R60Sat

	NMRI98				BVM(3)				b105L3g			
	Cumulative PDCS, %		Conditional PDCS, %		Cumulative PDCS, %		Conditional PDCS, %		Cumulative PDCS, %		Conditional PDCS, %	
Profile	Predicted	(Low-High)	Predicted	(Low-High)	Predicted	(Low-High)	Predicted	(Low-High)	Predicted	(Low-High)	Predicted	(Low-High)
TM1	0.579	0.161-1.613	0.579	0.161-1.613	0.317	0.164-0.573	0.317	0.164-0.573	1.850	1.535-2.210	1.874	1.544-2.255
	0.934	0.300-2.327	0.357	0.014-2.763	0.704	0.381-1.215	0.388	0.087-1.263	3.068	2.498-3.725	1.241	0.813-1.827
	1.058	0.384-2.426	0.126	0.000-11.008	0.704	0.381-1.215	0.000	0.000-0.004	3.466	2.744-4.312	0.410	0.071-1.556
	1.710	0.595-3.954	0.659	0.030-4.434	1.198	0.679-1.982	0.497	0.057-2.319	5.126	4.150-6.244	1.750	0.999-2.862
	2.039	0.796-4.352	0.334	0.000-9.834	1.515	0.848-2.523	0.321	0.001-6.062	6.250	4.978-7.712	1.184	0.416-2.761
	2.599	1.075-5.290	0.571	0.003-7.638	1.913	1.074-3.165	0.404	0.001-7.339	7.574	5.980-9.406	1.412	0.459-3.438
TM2	0.579	0.161-1.613	0.579	0.161-1.613	0.317	0.164-0.573	0.317	0.164-0.573	1.850	1.535-2.210	1.874	1.544-2.255
	0.872	0.283-2.166	0.295	0.008-2.736	0.638	0.333-1.136	0.322	0.054-1.261	2.982	2.436-3.610	1.153	0.755-1.698
	1.487	0.513-3.476	0.620	0.038-3.758	1.153	0.649-1.920	0.519	0.074-2.146	4.517	3.679-5.476	1.619	0.940-2.617
	2.165	0.896-4.436	0.688	0.027-4.878	1.797	1.075-2.832	0.651	0.054-3.445	6.053	4.779-7.528	1.609	0.719-3.157
	2.288	0.987-4.553	0.126	0.000-43.966	1.809	1.068-2.881	0.012	0.000-100.000	6.485	4.976-8.256	0.459	0.007-4.910
	2.659	1.169-5.197	0.379	0.000-11.132	1.956	1.116-3.195	0.150	0.000-36.899	7.579	5.799-9.659	1.170	0.215-3.992
TM3	0.579	0.161-1.613	0.579	0.161-1.613	0.317	0.164-0.573	0.317	0.164-0.573	1.850	1.535-2.210	1.874	1.544-2.255
	0.862	0.292-2.082	0.285	0.008-2.585	0.606	0.310-1.096	0.290	0.040-1.273	2.968	2.444-3.568	1.140	0.771-1.633
	1.450	0.502-3.388	0.593	0.035-3.688	1.095	0.604-1.852	0.492	0.067-2.097	4.474	3.677-5.381	1.585	0.950-2.497
	2.037	0.846-4.171	0.595	0.018-4.791	1.653	0.960-2.669	0.564	0.033-3.512	5.903	4.713-7.271	1.496	0.688-2.879
	2.710	1.117-5.521	0.687	0.008-7.119	2.215	1.319-3.495	0.572	0.009-5.801	7.506	6.032-9.182	1.744	0.694-3.693
	3.192	1.417-6.158	0.494	0.000-11.776	2.676	1.602-4.193	0.471	0.000-10.992	8.816	6.904-11.008	1.416	0.318-4.281
TM4	0.579	0.161-1.613	0.579	0.161-1.613	0.317	0.164-0.573	0.317	0.164-0.573	1.850	1.535-2.210	1.874	1.544-2.255
	0.815	0.282-1.944	0.237	0.004-2.612	0.537	0.263-1.007	0.221	0.017-1.362	2.920	2.439-3.466	1.091	0.767-1.512
	1.371	0.469-3.235	0.561	0.032-3.535	0.993	0.531-1.726	0.459	0.062-1.968	4.407	3.653-5.261	1.563	0.970-2.398
	1.807	0.721-3.817	0.442	0.004-5.331	1.415	0.777-2.391	0.425	0.011-3.780	5.664	4.593-6.886	1.314	0.620-2.492
	2.434	0.954-5.144	0.638	0.007-6.833	1.933	1.098-3.169	0.525	0.009-5.277	7.225	5.884-8.740	1.692	0.743-3.354
	2.798	1.189-5.583	0.373	0.000-14.116	2.279	1.291-3.736	0.353	0.000-13.080	8.414	6.717-10.344	1.282	0.325-3.643

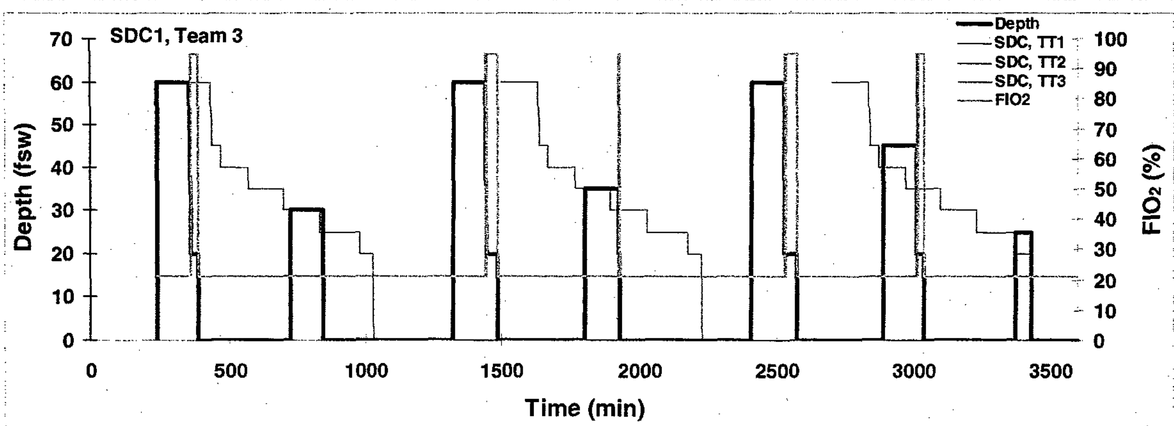
Figure I-3 (on following page I-8). Pressure and inspired FO_2 profiles of four two-man Tender teams supporting SDC1 operation in a hypothetical DISSUB rescue scenario. Tender decompression schedules prescribed by the Thalmann Algorithm VVal18 Air with In-Water Oxygen Decompression procedures. The three SDC1 decompression schedules for rescuees are also shown in each panel.



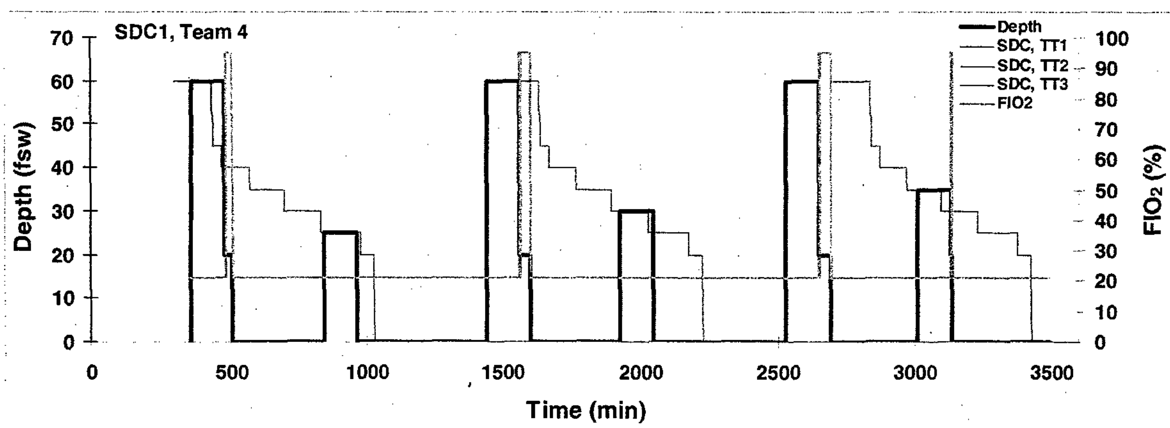
SDC1, Team 1
Depth
SDC, TT1
SDC, TT2
SDC, TT3
FIO2
Depth (fsw)
FIO2 (%)
Time (min)



SDC1, Team 2
Depth
SDC, TT1
SDC, TT2
SDC, TT3
FIO2
Depth (fsw)
FIO2 (%)
Time (min)



SDC1, Team 3
Depth
SDC, TT1
SDC, TT2
SDC, TT3
FIO2
Depth (fsw)
FIO2 (%)
Time (min)



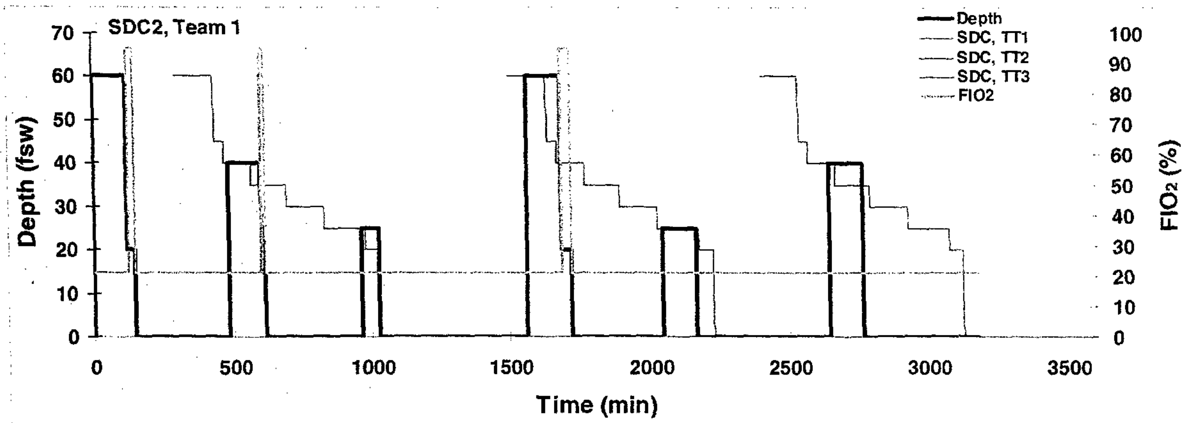
SDC1, Team 4
Depth
SDC, TT1
SDC, TT2
SDC, TT3
FIO2
Depth (fsw)
FIO2 (%)
Time (min)

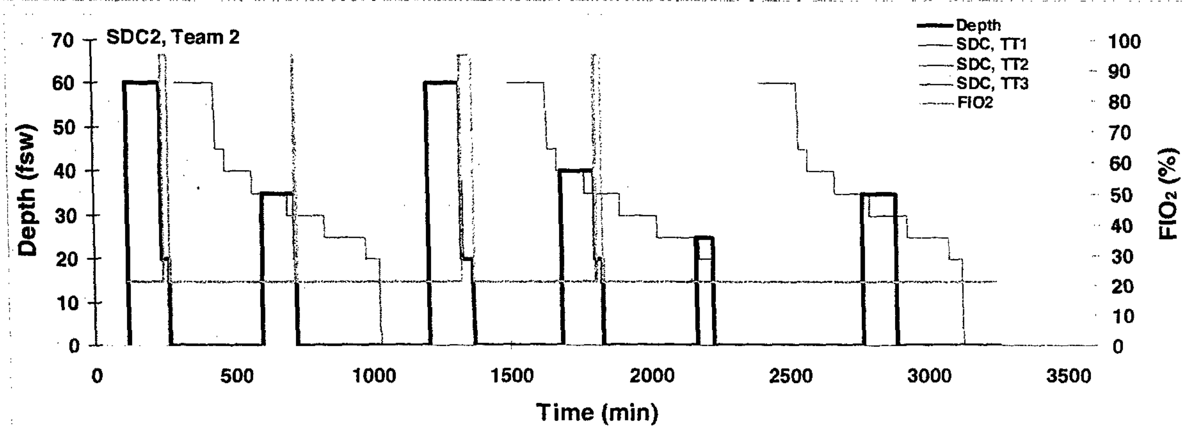
Table I-3
Estimated DCS Risks of SRDRS SDC1 Tender Profiles in Figure I-3

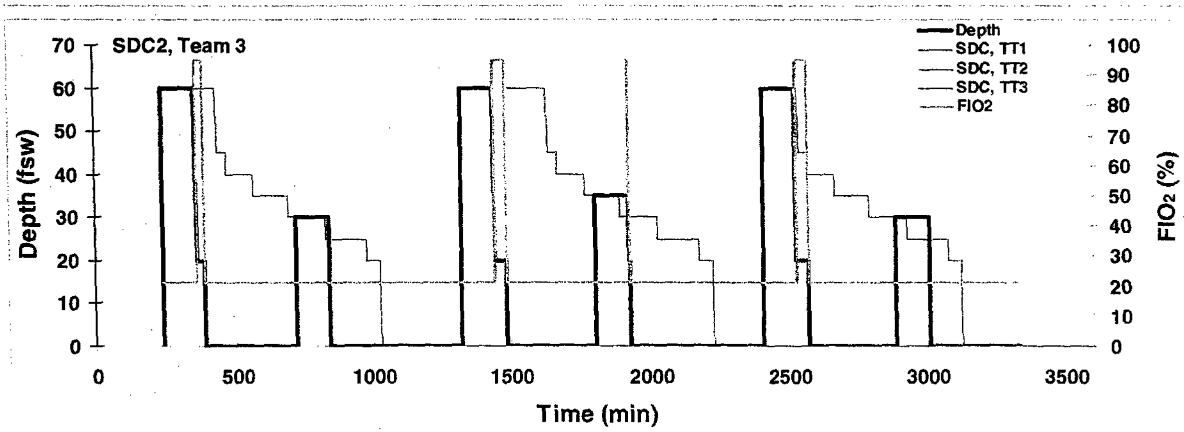
SRDRS_Tender_SDC1_R60Sat

	NMRI98				BVM(3)				b105L3g			
	Cumulative PDCS, %		Conditional PDCS, %		Cumulative PDCS, %		Conditional PDCS, %		Cumulative PDCS, %		Conditional PDCS, %	
Profile	Predicted	(Low-High)	Predicted	(Low-High)	Predicted	(Low-High)	Predicted	(Low-High)	Predicted	(Low-High)	Predicted	(Low-High)
TM1	3.031	2.320-3.886	3.056	2.284-3.998	2.733	2.245-3.293	2.735	2.215-3.336	3.721	3.258-4.228	3.770	3.293-4.293
	5.549	4.387-6.896	2.596	1.576-4.027	4.555	3.879-5.306	1.873	0.870-3.562	6.549	5.707-7.466	2.939	2.467-3.473
	6.033	4.806-7.446	0.512	0.009-5.005	4.886	4.115-5.749	0.347	0.000-20.234	7.377	6.401-8.440	0.886	0.471-1.548
	9.009	7.138-11.140	3.167	1.518-5.806	7.613	5.727-9.838	2.867	0.709-7.810	10.516	9.161-11.975	3.425	2.628-4.379
	10.318	8.268-12.626	1.438	0.150-6.285	8.666	6.646-11.009	1.140	0.002-16.471	12.367	10.751-14.101	2.069	1.224-3.284
	13.291	10.643-16.236	3.313	1.058-7.791	11.427	8.722-14.529	3.026	0.266-12.694	15.373	13.399-17.472	3.503	2.300-5.091
	15.307	12.464-18.421	2.324	0.305-8.687	13.074	10.205-16.306	1.860	0.004-21.089	17.793	15.512-20.205	2.860	1.543-4.838
TM2	3.031	2.320-3.886	3.056	2.284-3.998	2.733	2.245-3.293	2.735	2.215-3.336	3.721	3.258-4.228	3.770	3.293-4.293
	5.374	4.271-6.649	2.416	1.481-3.724	4.681	3.950-5.498	2.003	0.965-3.706	6.445	5.621-7.342	2.830	2.399-3.314
	8.432	6.706-10.398	3.231	1.698-5.554	7.551	6.248-9.007	3.019	1.118-6.544	9.433	8.214-10.750	3.238	2.561-4.033
	11.168	9.032-13.554	2.988	1.125-6.417	9.588	8.103-11.218	2.204	0.221-9.250	12.293	10.657-14.051	3.208	2.278-4.380
	11.728	9.542-14.157	0.629	0.000-13.330	10.010	8.431-11.744	0.467	0.000-53.931	13.229	11.437-15.153	1.067	0.301-2.873
	14.590	11.808-17.653	3.241	0.920-8.141	12.630	9.980-15.604	2.912	0.157-14.409	16.283	14.128-18.575	3.583	2.245-5.397
	15.839	12.907-19.044	1.461	0.031-11.008	13.641	10.867-16.730	1.157	0.000-35.941	18.089	15.697-20.620	2.157	0.878-4.467
TM3	3.031	2.320-3.886	3.056	2.284-3.998	2.733	2.245-3.293	2.735	2.215-3.336	3.721	3.258-4.228	3.770	3.293-4.293
	4.936	3.905-6.135	1.965	1.099-3.259	4.274	3.553-5.088	1.584	0.602-3.469	6.146	5.346-7.018	2.518	2.056-3.052
	7.854	6.198-9.753	3.068	1.586-5.343	7.038	5.753-8.488	2.889	1.107-6.145	9.075	7.901-10.344	3.156	2.423-4.034
	10.428	8.496-12.583	2.792	1.105-5.831	9.163	7.641-10.847	2.286	0.297-8.607	11.901	10.356-13.560	3.108	2.241-4.192
	13.437	10.913-16.226	3.359	1.166-7.526	11.960	9.875-14.257	3.094	0.361-11.668	14.859	12.933-16.912	3.463	2.299-4.990
	16.070	13.171-19.227	3.040	0.682-8.657	13.924	11.683-16.359	2.232	0.026-17.328	17.641	15.325-20.093	3.366	1.969-5.349
	16.607	13.664-19.802	0.639	0.000-25.142	14.332	12.006-16.858	0.474	0.000-80.195	18.580	16.104-21.198	1.140	0.154-4.538
TM4	3.031	2.320-3.886	3.056	2.284-3.998	2.733	2.245-3.293	2.735	2.215-3.336	3.721	3.258-4.228	3.770	3.293-4.293
	4.237	3.288-5.358	1.244	0.508-2.616	3.689	3.049-4.417	0.982	0.198-3.231	5.566	4.836-6.364	1.916	1.517-2.388
	7.324	5.725-9.174	3.223	1.798-5.309	6.557	5.262-8.037	2.979	1.282-5.881	8.658	7.545-9.864	3.312	2.612-4.134
	9.448	7.617-11.510	2.291	0.770-5.337	8.278	6.781-9.958	1.842	0.152-8.546	11.157	9.701-12.725	2.735	1.899-3.811
	12.337	9.906-15.047	3.189	1.091-7.224	10.992	8.909-13.316	2.963	0.385-10.782	14.068	12.243-16.016	3.356	2.196-4.892
	14.829	12.159-17.751	2.842	0.672-7.933	13.051	10.758-15.570	2.314	0.050-15.459	16.860	14.689-19.161	3.249	1.957-5.055

Figure I-4 (on following page I-11). Pressure and inspired FO_2 profiles of four two-man Tender teams supporting SDC2 operation in a hypothetical DISSUB rescue scenario. Tender decompression schedules prescribed by the Thalmann Algorithm VVal18 Air with In-Water Oxygen Decompression procedures. The three SDC2 decompression schedules for rescuees are also shown in each panel.


SDC2, Team 1
Depth
SDC, TT1
SDC, TT2
SDC, TT3
FIO2
Depth (fsw)
FIO2 (%)
Time (min)


SDC2, Team 2
Depth
SDC, TT1
SDC, TT2
SDC, TT3
FIO2
Depth (fsw)
FIO2 (%)
Time (min)


SDC2, Team 3
Depth
SDC, TT1
SDC, TT2
SDC, TT3
FIO2
Depth (fsw)
FIO2 (%)
Time (min)

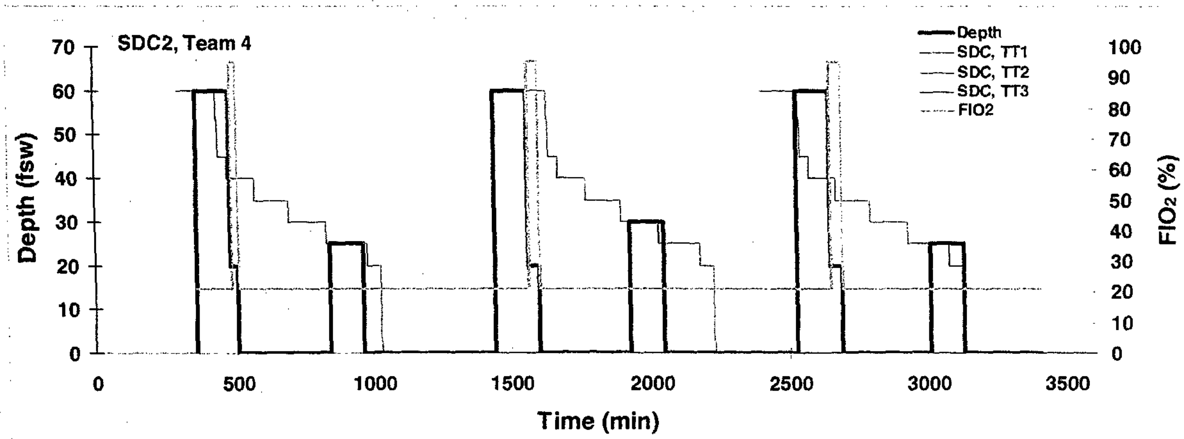

SDC2, Team 4
Depth
SDC, TT1
SDC, TT2
SDC, TT3
FIO2
Depth (fsw)
FIO2 (%)
Time (min)

Table I-4
Estimated DCS Risks of SRDRS SDC2 Tender Profiles in Figure I-4

SRDRS_Tender_SDC2_R60Sat

	NMRI98				BVM(3)				b105L3g			
	Cumulative PDCS, %		Conditional PDCS, %		Cumulative PDCS, %		Conditional PDCS, %		Cumulative PDCS, %		Conditional PDCS, %	
Profile	Predicted	(Low-High)	Predicted	(Low-High)	Predicted	(Low-High)	Predicted	(Low-High)	Predicted	(Low-High)	Predicted	(Low-High)
TM1	3.031	2.320-3.886	3.056	2.284-3.998	2.733	2.245-3.293	2.735	2.220-3.330	3.721	3.258-4.228	3.770	3.293-4.293
	5.549	4.387-6.896	2.596	1.576-4.027	4.555	3.879-5.306	1.873	0.870-3.562	6.549	5.707-7.466	2.939	2.467-3.473
	6.033	4.806-7.446	0.512	0.009-5.005	4.886	4.115-5.749	0.347	0.000-20.234	7.377	6.401-8.440	0.886	0.471-1.548
	9.009	7.138-11.140	3.167	1.518-5.806	7.613	5.727-9.838	2.867	0.709-7.810	10.516	9.161-11.975	3.425	2.628-4.379
	10.318	8.268-12.626	1.438	0.150-6.285	8.666	6.646-11.009	1.140	0.002-16.471	12.367	10.751-14.101	2.069	1.224-3.284
	12.992	10.634-15.592	2.980	0.987-6.910	10.813	8.543-13.380	2.351	0.109-12.733	15.405	13.457-17.476	3.467	2.328-4.948
TM2	3.031	2.320-3.886	3.056	2.284-3.998	2.733	2.245-3.293	2.735	2.220-3.330	3.721	3.258-4.228	3.770	3.293-4.293
	5.374	4.271-6.649	2.416	1.481-3.724	4.681	3.950-5.498	2.003	0.965-3.706	6.445	5.621-7.342	2.830	2.399-3.314
	8.432	6.706-10.398	3.231	1.698-5.554	7.551	6.248-9.007	3.019	1.118-6.544	9.433	8.214-10.750	3.238	2.561-4.033
	10.424	8.391-12.705	2.175	0.578-5.819	9.135	7.677-10.742	1.714	0.072-10.156	11.781	10.187-13.500	2.613	1.739-3.767
	10.892	8.822-13.203	0.521	0.000-14.387	9.450	7.912-11.147	0.346	0.000-66.452	12.625	10.881-14.503	0.956	0.232-2.832
	12.465	10.176-14.996	1.764	0.239-6.720	10.626	8.866-12.564	1.299	0.001-18.980	14.891	12.886-17.033	2.594	1.459-4.263
TM3	3.031	2.320-3.886	3.056	2.284-3.998	2.733	2.245-3.293	2.735	2.220-3.330	3.721	3.258-4.228	3.770	3.293-4.293
	4.936	3.905-6.135	1.965	1.099-3.259	4.274	3.553-5.088	1.584	0.602-3.469	6.146	5.346-7.018	2.518	2.056-3.052
	7.854	6.198-9.753	3.068	1.586-5.343	7.038	5.753-8.488	2.889	1.107-6.145	9.075	7.901-10.344	3.156	2.423-4.034
	10.428	8.496-12.583	2.792	1.105-5.831	9.163	7.641-10.847	2.286	0.297-8.607	11.901	10.356-13.560	3.108	2.241-4.192
	13.437	10.913-16.226	3.359	1.166-7.526	11.960	9.875-14.257	3.094	0.361-11.668	14.859	12.933-16.912	3.463	2.299-4.990
	15.523	12.812-18.474	2.408	0.390-8.182	13.654	11.360-16.159	1.925	0.007-19.340	17.352	15.104-19.733	2.928	1.624-4.852
TM4	3.031	2.320-3.886	3.056	2.284-3.998	2.733	2.245-3.293	2.735	2.220-3.330	3.721	3.258-4.228	3.770	3.293-4.293
	4.237	3.288-5.358	1.244	0.508-2.616	3.689	3.049-4.417	0.982	0.198-3.231	5.566	4.836-6.364	1.916	1.517-2.388
	7.324	5.725-9.174	3.223	1.798-5.309	6.557	5.262-8.037	2.979	1.282-5.881	8.658	7.545-9.864	3.312	2.612-4.134
	9.448	7.617-11.510	2.291	0.770-5.337	8.278	6.781-9.958	1.842	0.152-8.546	11.157	9.701-12.725	2.735	1.899-3.811
	12.337	9.906-15.047	3.189	1.091-7.224	10.992	8.909-13.316	2.963	0.385-10.782	14.068	12.243-16.016	3.356	2.196-4.892
	13.705	11.128-16.549	1.560	0.085-8.639	12.096	9.877-14.553	1.241	0.000-24.562	15.956	13.853-18.192	2.197	1.005-4.204